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On the Natural History of the Honey Bee, and the importance of its products.

[Extracted from the North American Review, for October last.]

[CONCLUDED FROM PAGE 43.]

The little work, the title of which we have prefixed to this article, called "The Farmer's Manual," contains, in a small compass, as much of the minutiæ of the *management* of bees, as is necessary to the common cultivator. Mr. Butler is a sensible, practical writer, as well on other branches of rural economy, as on bees, and we would recommend his book to all who are engaged in those pursuits; for, with some slight deviations from his rules, such as a different climate would indicate, his experience may be beneficial to all.

We esteem it a very desirable object to make the care of the bee more common than it has, hitherto, been, in this part of the country. With the exception of a small one under the superintendence of the society of the Shakers, established at New Lebanon, we neither saw, nor could we hear of more than a single apiary, on a journey last summer to Lebanon Springs, although we made many inquiries. Never was there a country more suited to the cultivation of bees. Even in August, there is an abundance of white clover, and small springs and shallow rivulets appear at every turn. There is no doubt that bees were, formerly, more frequently kept in America, than at present. In many places in New Jersey, where there is now scarcely a bee to be seen, there once existed millions of these insects, to the great profit of their owners. It was common for one dealer in a country town, to sell from fifteen to twenty barrels of strained honey alone, to say nothing of wax and comb-honey, as well as a

kind of wine, made of the washings of combs, called *metheglin*. These articles of commerce, have almost disappeared, and we find that it is mainly attributable to the ravages of the millers, or night-moths, which have of late years spread destruction through the hives.

The attention of naturalists has been directed to the history of this fatal enemy of the bee, and many attempts have been made to construct hives that would prevent the miller from depositing its eggs in them; but the plans were defective, because there was no contrivance for inspecting the hives. Before we close this article, we will endeavour to give a description of a hive, that is so constructed as to enable any one to see the interior, and to free it from all extraneous matter, as well as to protect it from the inroads of the night-miller.

On the general subject of the care of bees, the following remarks, the result of personal experience, may be acceptable to the reader.

The situation of an apiary, is of little importance. We have seen bees thrive as well with an eastern, as with a northern aspect. If the entrance of the hive face the north, the bees may, possibly, be detained within, a minute or two later in summer; but this is more than counterbalanced, by the same cause operating in winter, when it is desirable that the bees should remain in the hive. But, for ourselves, we have seen no difference in the time of quitting the cells, between those that faced the north, and those that had a southern exposure. Nor have we observed that there is any difference in the welfare of hives, as placed in valleys or elevated on hills, meaning, of course, hills of thirty or forty feet in height.

We have seen hives prosper, adjoining a stercorary, and, oftentimes, near a piggery. We have known colonies of bees to exist for a term of twenty years, with no other protection from the heat and cold, than the top of the hives. They have multiplied equally well under an open shed; but as a free circulation of air is necessary to their health and comfort, we have never known them to thrive when quite enclosed. A house, therefore, strictly so called, which is shut on all sides, may serve to amuse the observer for a year or two, but there must be an extraordinary combination of fortunate circumstances, if the bees increase, while confined in it.

It is better to begin with a single hive, and so attain a knowledge of the habits and instincts of the bees, by degrees. We have known several persons, who have purchased a number of hives at once, and relinquished the pursuit, from the perplexity that ensued when the swarming season commenced. But there is no similar occupation so easily followed, and none that requires so little capital, as that of keeping bees. The profit is enormous. If a person, well trained to the employment, should follow the plan adopted in some parts of Europe, of removing the bees from place to place, in a kind of ark on a river of some length, thus providing a plentiful supply of food, he might increase his stock to any extent.

An apiary of twenty hives, could maintain itself in an area of a mile, where there is plenty of blossoms. Every farmer should, however, provide pasture for his bees, as well as for his cows; and,

therefore, when the spring and summer flowers are gone, he should have a field of buckwheat ready, which, although not so palatable as other flowers, will serve the bees for winter food.

An apiary, or bee-shed, should be, at the eaves, about four feet from the ground, with a roof sloping both ways, and with any aspect that the owner chooses. It should be ten feet wide, and the length of it should be increased, as the hives multiply. It is, however, difficult to describe one accurately.

The most convenient one that we have seen, is on a farm near New Brunswick, in New Jersey. It is fifty feet long, and contains sixteen hives on each side. The swarms which are successively cast off, are placed under the same shed in the winter, and an equal number of the old hives are sold, to make room for them. This apiary might be enlarged to any extent, were there pasture enough for the bees; but the area of the bees' flight, as there are now many cultivators of bees in this district, does not furnish food enough for a great number.

In this apiary, the miller, or night-moth, is successfully guarded against. A small wire door, made to slide behind two door-posts, formed of needles, is closed over the entrance of the hive, as soon as the bees have retired for the night. This is done during the months of April, May, and June; after that, if the weather sets in warm, and the bees are oppressed by heat, the floor of the hive is let down, which, as it is fastened to the hive behind, with hinges, and on the sides with hooks and staples, can easily be accomplished. Two rows of scantlings, or joists, four inches square, and running the whole length of the apiary, receive the hives between them, which are thus suspended at a distance of about three feet from the ground.

The hive is thirteen inches square at the *top*, and is of the same size at the bottom of the front and back, but the bottom of the *sides* is only seven inches wide. By this slope of the hive, the combs wedge themselves as they are made, and there is no use for the ill contrived crossed sticks, that are generally thrust in the old hives, to keep the combs from falling down by their own weight. The floor is, as we observed, fastened by hinges and hooks. It is, likewise, an inclined plane, having a slope of at least four inches.

The advantages of this inclination, will be instantly seen. The perspiration of the bees, which is copious, is, by the inclination of the sides and floor, conveyed off at once, without being absorbed by the boards. All extraneous matter can be carried away by the bees, with very little trouble, and they can defend themselves from robbers, or corsair bees, with much greater ease than if the floor were flat.

As the floor opens and shuts, the observer can inspect the interior of the hive at pleasure, not with the hope of getting at the minutiæ of the bees' policy, but to see the forwardness of the combs, the number of the bees, and the general appearance, which a practised eye can soon understand. When the floor of the hive is left down all night, and the bees hang very low from the combs in the

morning, they will soon remove themselves up again, if the floor is raised very gently and slowly, and fastened as usual.

The cover of the hive is, of course, thirteen inches square. It is made of common pine, as is the hive, with two cleats on the upper part, as well to prevent the board from warping, as to prevent the box, or upper story, which is always added, from being moved from its place. The cover of the hive has three holes, of one inch diameter, within a quarter of an inch of each other. These holes are to allow the bees to pass to the upper box, when the *hive* is full of honey.

It is ascertained, satisfactorily, that the young brood and the bee-bread, or pollen, are deposited in the hive where the swarm is first put. The holes in the cover are, therefore, kept shut by plugs, until the hive be filled. The holes are then opened, the bees immediately pass up, and if the season be propitious, they fill the upper box with comb and honey, which, as there is neither brood nor bee-bread, is of the finest and purest kind.

We have often seen forty and sixty pounds obtained by this simple proceeding; and the box is also used to feed a famished hive, in the spring. A single comb left in one of these boxes, will sustain a swarm, that has eaten up all its honey, until vegetation commences. As the boxes and hives are of equal size, any one box will fit a hive.

When the combs in the hive are three years old, two of them can be taken out every winter, provided there remain honey enough in the rest, for the use of the bees. Thirty weight of honey is the average quantity that suffices for a swarm of large size. The hives in question weigh, when empty, about twelve pounds, a swarm of bees, four pounds, the wax, two pounds. The whole, therefore, ought to weigh about fifty pounds, in November. All over this quantity, can be taken out to advantage, as the wax becomes very dark after two or three years. The whole of the combs can be thus renewed in the course of four years, as the bees replace them early in the spring. We omitted to mention that the length of the back of the hive, is twenty-two inches, and of the front, twenty-eight inches, and that the floor projects in front about three inches, thus forming an apron, or platform, on which the bees alight before they enter in at the little door. Models of this hive have been sent to several of the horticultural societies of Europe, and they are getting into use in this country.

When a swarm is to be hived, the hive is put in a moveable frame, which is easily carried to the tree where the swarm hangs, and this is proved to be the easiest method of hiving swarms; as the screws are taken out of the cover, and the hive lifted up to the swarm, into which they are shaken. The frame and hive are then placed on the ground, and the cover is *gently* laid on and screwed fast to the hive. Little sticks are put against the apron, and rest on the ground, serving for ladders for those bees that fell to the ground, when the main body was shaken into the hive. Bees, from the moment of their leaving the hive, when swarming, until they are fairly settled and at work in a new habitation, seem stupid and confused. This arises,

however, from the precarious situation of their queen. If she fall into the hive when the swarm is shaken in, all the remaining bees will soon find their way to the entrance; for a peculiar sound is emitted by these insects when their queen is present. If, however, she remain on the limb, it will be necessary to shake it again over the hive, as the bees will leave it to fly up to the place where the queen is. When the bees are quiet in the hive (which is ascertained by the number that are seen hovering in front of the entrance, on the wing, and by others ventilating the hive with their wings,) the top can be covered with a sheet, doubled several times, to keep off the heat of the sun. The hive must remain in the same spot, until eight or nine o'clock in the evening, when two persons can quietly and gently convey it, frame and all, to the apiary, and place the hive, with great care, between the joists where it is permanently to remain.

Hives should be made and painted a year before they are used, as the smell of paint is disagreeable to the bees. The smoother the boxes and hives are, inside and outside, the better both for the health of the bees and for preventing the deposit of the eggs of the miller. We must except the *roofs* of the hive and of the box, as they should be rough; for we have ascertained, that the propolis, or bee-glue, does not adhere so closely to a smooth surface at all times.

And here we would remark, that it has been the custom, from the earliest ages, to rub the inside of the hive with a handful of salt and clover, or some other grass or sweet-scented herb, previously to the swarm's being put in the hive. We have seen no advantage in this; on the contrary, it gives a great deal of unnecessary labour to the bees, as they will be compelled to remove every particle of foreign matter from the hive, before they begin to work. A clean, cool hive, free from any peculiar smell or mustiness, will be acceptable to the bees; and the more closely the hive is joined together, the less labour will the insects have, whose first care it is to stop up every crevice, that light and air may be excluded. We must not omit to reprehend, as utterly useless, the vile practice of making an astounding noise, with tin pans and kettles, when the bees are swarming. It may have originated in some ancient superstition, or it may have been the signal to call aid from the fields, to assist in the hiving. If harmless, it is unnecessary; and every thing that tends to encumber the management of bees, should be avoided.

Straw hives are unsuitable to our climate, and afford a harbour for all kinds of insects. It is folly to talk of their cheapness. If a man intend to keep bees, he must, in the first place, make the hives in the very best manner; by this we mean, of good materials and of good workmanship. A hive badly joined, by an awkward carpenter, is worse than a hollow tree. One half of the labour of the bees, is directed to the repairs of their dwelling.*

* A model of the hive which we consider of the best construction, may be seen at the village of the Lebanon Shakers, in the hands of Mr. Daniel Hawkins, or at the seat of Theodore Sedgwick, Esq. in Stockbridge. The inventor of this hive has had an opportunity of judging of its merits, by experience.

It is not asserted that the bees will, of themselves, fall into these hives, or that no trouble or expense is necessary in the management of an apiary. We know that both care and expense are required; but the latter, after the first disbursement, is very trifling. Vigilance and neatness, are for ever in requisition, and the care of bees, like all other profitable business, cannot be pursued to any advantage, unless it receive daily and minute attention. But have we not accomplished a great deal when we have reduced the thing to this certainty?

But, although, as we have before observed, nothing is more simple in theory and practice, than the history and care of bees, yet it requires a constant and unremitted attention, if we aim either at instruction or profit. Can any thing be done well and to advantage, without these? Varro, in his treatise *de Re Rusticâ*, is the first who has spoken of *hives*. He wrote upwards of 1870 years ago; and how many different sorts of hives have been constructed since his time, to say nothing of the different theories? We wish to see bees in every garden throughout America, but we have no desire to see the subject encumbered with more than is necessary to advance the pleasure and profit of the pursuit. To the naturalist, we will leave discussions of organization and propagation. They are foreign to our purpose, as they only serve to perplex and deter us from the main points. But it is proper to know the most simple mode of managing a hive, and this includes the pasture, or food, that is necessary for its sustenance. Hunger destroys as many bees as the miller. We ought to cultivate such shrubs and plants as the bees like; without this, they will starve. The American black willow, and the red maple, are the first trees that are visited by the bees. They are fond of the crocus, which is the earliest of our bulbous roots; and these we can have in abundance, as they multiply quickly and occupy little space. They are beautiful in themselves, affording a rich treat to the eye; and they flower so early, and are of such bright and vivid colours, that we take as much pleasure in them as the bees do. The stercorary and piggery, are next resorted to by these insects. These, we presume, are their medicine shops, and the extract absorbed from them, must be used as a tonic. Blossoms of all kinds, excepting those of the red clover and of the honey-suckle, are excellent food; and the bees especially profit by the increased attention bestowed, at present, in some parts of this country, on the cultivation of the peach-tree. They not only drink the nectar and abstract the pollen of the flower, but they appropriate the peach itself. We have seen twenty or thirty bees devour a peach in half an hour; that is, they carried the juices of it to their cells. The humming-bird alone, can reach the bottom of the nectary of the honey-suckle, but even here the instinct of the bee is seen. The small birds, such as the wren, make an incision on the outside, near the bottom of the flower, and extract a part of the juices. The bee takes advantage of this opening, and avails itself of what is left.

The scent of the bees is so acute, that every flower which has a powerful odour, can be discovered by them at a great distance.

Strawberry-blossoms, mignonette, wild and garden thyme, herbs of all kinds, apple, plum, cherry; and, above all, raspberry blossoms, and white clover, are delicious food for them, and a thriving orchard, and garden, and apiary, fitly go together.

But, as the bee seeks only its own gratification in procuring honey, and in regulating its household, and as, according to the old proverb, what is one man's meat, is another's poison, it sometimes carries honey to its cell, which is prejudicial to us. Dr. Barton, in the fifth volume of the American Philosophical Transactions, speaks of several plants that yield a poisonous sirop, of which the bees partake without injury, but which has been fatal to man. He has enumerated some of these plants, which ought to be destroyed wherever they are seen, namely, dwarf-laurel, great laurel, kalmia latifolia, broad-leaved moorwort, Pennsylvania mountain-laurel, wild honey-suckle (the bees, as we observed, cannot get much of this,) and the stramonium, or Jamestown-weed; which last we should wish to see completely eradicated, as, independently of the poison extracted from its flowers, and from its seeds, which are often eaten by children, it is the ugliest weed that grows, and has the most offensive odour.

The poets, always exalting and magnifying the subjects that they touch, have contributed, perhaps, more than any other set of writers, to mislead our judgment. They endow the bee with memory, and Rogers thinks that it finds its way to the hive, by this faculty alone. Nor is it only with regard to the bee, that poets, the worst entomologists in the world, have led us astray.

Cowper says,

> "I would not enter on my list of friends,
> Though graced with polished manners and fine sense,
> . . . . the man,
> Who needlessly sets foot upon a worm."

By *worm*, we wonder if he included the grub-worm. Alas! little did that amiable man think of the mischief that would ensue from this sensibility and tenderness towards insects. He thought that when nature created them, and designed them an "abode," that it was a species of cruelty to hunt or harm them, when not actually crawling "in th' alcove, the chamber, or refectory." But the harm that the few do, who so inadvertently approach our dwellings, is insignificant when compared to the ravages of every kind of insect, excepting the bee, when in the abode that nature assigned it. This very worm, from which they bid us turn aside when we meet it in our path, after destroying the roots of our pasture and our corn, becomes a winged insect, and continues its mischief to the destruction of our finest fruits.

We really are in a sad plight between our sensibilities and our sense of justice to ourselves. We say that insects have so multiplied, that we can neither raise grain for our cattle, nor fruit for ourselves. "Keep the birds near you," say the philosophers, "quit the cruel practice of shooting the harmless songsters of the grove, and you will not only be rewarded by seeing that insects decrease,

but you will be charmed by their melody." But, then, we say in answer, that the birds do not discriminate; that they prefer bees to every other insect, and, therefore, the birds must die. And in reality, we must make war upon those birds, that show the greatest fondness for our little friends. Let us, at least, show our sense of the value of these, by keeping their enemies away, at any rate, from their very doors. Let us lessen the chance of their encountering them abroad, by planting the favourite food of the bees, as near the apiary as possible; and, also, lessen the chance of their being drowned, when driven by high winds, as they stoop to drink, by giving them running streams near to their hives.

We have scarcely observed any order in this discussion, setting down our thoughts just as they presented themselves. Had we written a regular work on this subject, we would in the proper place have spoken of the small bees, the aged, and those denominated *black*. As this essay is short, it will not be difficult for those who have a respect for our opinions, to cull out and methodize the different matter as it occurs, and we can then ramble on with our few remaining observations, to the close.

In the hive of a new swarm, during the months of July and August, there are fewer small bees, than in one that has been tenanted for four or five years. The bee, like all other insects, spins itself a covering before it becomes a fly. When it emerges with wings, from its cell, several older bees approach it, feed it with the contents of their stomachs, and then clean out the cell and deposit in it fresh honey. This is their constant practice; and the bee that is just born, as soon as it has been fed and has stretched its wings, flies off to a flower, and commences its labours. But, although the bees clean out the cell the moment a young bee is born, yet they either find no inconvenience from that part of the film, which the young bee leaves at the bottom of the cell, and which is of a silky nature, or they are unable to detach it. In consequence of this, the cell is not so deep, and as the same circumstances occur perpetually, brood alternating with honey, the cells become every year visibly smaller; and, consequently, those bees that are bred in these small cells, of which there is a great number, are never of the full size of those that have had more room. Even the queen eggs, which *we* say are often deposited in the cells of neuters, and have, afterwards, larger cells attached to the first, never produce so large a queen bee, as if the cell had been of proper dimensions at first. Thus we see that the contraction of the cell may diminish the *size* of a bee, even to the extinction of life, just as the contraction of a Chinese shoe reduces the foot even to uselessness; but in neither case will a single new organ be taken from, or added to the bee, or a single toe be taken from, or added to the foot, whether the cell, or shoe, be larger or smaller.

A young bee can readily be distinguished from an old one, by the grayish coloured down that covers it, and which it loses by the wear and tear of hard labour; and if the bee be not destroyed before the season is over, this down entirely disappears, and the ground-work

of the insect is seen, white or black. On a close examination, very few of these black, or aged bees, will be seen at the opening of the spring, as, not having the stamina of those that are younger, they perish from inability to encounter the vicissitudes of winter.

Our seasons are very variable. The scorching droughts of summer, deny to plants their accustomed moisture; no honey, therefore, can be made by the bees at such times, and they are compelled to eat of their winter food. They cluster about the hive, or, deprived of their accustomed labour, they are very restless, and often intrude into a neighbouring hive, apparently for the want of employment. In the summer of 1825, during the latter part of July, the heat was so distressing to the bees, the thermometer standing at 92° in the shade, that they seemed to have lost their usual instinct. A number of hives of the old-fashioned patterns, that stood on a bench, were well filled with bees. At two o'clock, for three days in succession, the whole swarm of each hive rushed out, and ran into the adjoining hive, where they remained for a few seconds, without apparent offence to the invaded bees, who, in their turn, flew madly out, and paid the same unceremonious visit to their neighbours. No quarrel ensued, not a bee was killed by these irruptive movements. They seemed maddened by the heat; and yet the queen was left in the hive, for with all our attention to the sallying parties, we did not see a single queen among them. The same frenzy did not occur in those hives that were suspended upon joists; thus proving that the bees did not suffer so much from heat in those suspended hives, as they did in the flat-bottomed ones, that rested on a bench.

Our winters are equally disastrous to the poor bees. Of late years, there have been so many mild days during the cold season, that a great deal of honey has been consumed. These alternations of torpor and animation, cause greater exhaustion and loss of physical powers, than would be occasioned by a continuance of uniform torpor. This we infer from the fact, that in Russia, where the winters are uniformly cold, bees do not perish; and in the West Indies, where there is perpetual verdure, they are never exhausted.

But, although a bee may remain torpid, to a certain extent, for six months in the year without injury, in those climates to which the insect has long been accustomed, yet it could not exist for the same space of time in lower latitudes, where such a period of continued cold rarely occurs. Nature has not constructed them for every emergency. She has done no more for them in this particular, than she has for man. They are compelled to get accustomed to a change of climate, by degrees; not by an alteration of the structure of their organs, for that can never occur under any circumstances, but by some change that takes place in the circulation of the fluids of the body, by which the system is accommodated to a higher or lower temperature. But we leave this part of the question to the naturalists learned in the science.

If we are correct in this our opinion, the suggestion of Dr. Anderson would not be available in our climate. If, according to his proposal, bees were to be kept all winter in an ice-house, more causes

than one would operate to the injury of their health, and, consequently, to the decrease of their number. The temperature of an ice-house, unless we are to suppose the hive to be buried in the ice itself, is much higher than that which is without the house. The torpor, therefore, would not be so complete, as to put a stop to the digestive process. The bees would be compelled to eat; and as their food is constantly in contact with the impure, stagnant air of the ice-house, it would soon become vitiated, and engender diseases.

We know of but two diseases to which the bees are subject, in this country, and they have, to our knowledge, never occurred at any other season, than the early part of the spring,—dysentery and dyspepsia. The latter arises from the indolent, inactive life that they are *compelled* to lead, in our variable winters. The rule holds good with the most diminutive, as well as the greatest, in animal life, that "if we eat and wish to preserve health, we must work."

During the last winter, (1828,) the bees suffered more, and lost more of their numbers, than has often been known before. There was scarcely a day that they did not sally out to search for employment and food; but not being properly stimulated, they seldom returned to the hive. We frequently saw them crawling on the ground, weak and spiritless; and those that did return, soon perished. On examining the hives, we observed that nearly all the honey was consumed; and many of the brood, that, in ordinary seasons, are not hatched until the first part of April, assumed the fly form at an earlier period, and died.

The cure for this disorder the bees take into their own hands. As soon as the flowers appear, they go to *work;* and then it is, that they resort to aperients and tonics, which they abstract from the floors of the piggeries.

The other disease proceeds from long confinement in bad air, and from unwholesome food, and is, invariably, fatal; nor can the bees avert it by any instinct of their own. We know of no cure for the dysentery, when the bee is seized with it. Those that have it badly, must die. We can restore those that are least affected, by frequently washing the hives, as far as we can reach, with weak lye, and by ventilating them and removing the dead bees.

Much has been said of the danger to be apprehended from placing an apiary too near our own dwelling. There is, indeed, no positive advantage in having it very near; but as the person usually engaged in hiving the bees, is occupied with farming affairs, and is not always present when the bees swarm, it is proper that the apiary should be within sight of the family. A bee, certainly, has frequently attacked a horse, and we have once or twice heard of one being stung to death. Considering the great number of hives of bees, it is really wonderful, that more accidents of this kind have not occurred. But they are exceedingly rare; and when we know how many hundred horses annually die from the disease called *the botts*, which proceeds from the maggots of the egg, laid by the *horse-bee* on the hair of the animal, the very few that suffer from the sting of the honey-bee, do not deserve to be taken into consideration.

In every point of view, therefore, it appears that bees should be cultivated. The wax that is consumed in this country, in various ways, is enormous, and most of it is imported. If we may credit Huish, Great Britain imports from Germany and Italy, upwards of eighty thousand pounds sterling worth of wax annually. We are unable to say, with any precision, to what amount it is imported by us; but judging from the quantity that each family uses in a year, and the amount employed in various arts, it must be worthy of notice.

It is really disgraceful to such a country as ours, to import wax or honey. We ought, ourselves, to export tons of it every year; and we trust that, in the course of a few years, this improvement will take place. Massachusetts and Connecticut are well situated, and abundantly supplied with proper food for bees; and their climate, being less variable, is better adapted to their nature. We spoke of hills of twenty or thirty feet in height; this only applies to the site of an apiary near a dwelling. The dwelling itself may be on a hill. We have heard of convents situated on mountains, that have been well stocked with hives. In short, nothing is wanting but good pasture, good hives, cleanliness, and attention, to insure a rich reward to those who engage in the pursuit.

Children are, naturally, very fond of watching the proceedings of bees, and they would soon learn to take care of them, if they were not taught to fear them. All danger can be guarded against, by making them wear woollen gloves that are long enough to draw over their sleeves at the wrist, and a wire cap to cover their head. They could thus be trained to manage bees; and training is quite as necessary to the full comprehension of the occupation, as it is in the trade of a carpenter or shoemaker.

It would be unjust not to refer again to Mr. Butler's little book, after making it the occasion of expressing our own thoughts. We shall rejoice if our slender notice of his work should encourage him to put forth a new edition; and we shall now take leave of the subject, although it be almost inexhaustible, by an anecdote, that we have reserved for the conclusion, that it may make the deeper impression.

A good old French bishop, in paying his annual visit to his clergy, was very much afflicted by the representations they made of their extreme poverty, and which the appearance of their houses and families corroborated. Whilst he was deploring the state of things which had reduced them to this sad condition, he arrived at the house of a curate, who, living amongst a poorer set of parishioners than any he had yet visited, would, he feared, be in a still more woful plight than the others. Contrary, however, to his expectations, he found appearances very much improved. Every thing about the house wore the aspect of comfort and plenty. The good bishop was amazed. "How is this, my friend?" said he; "you are the first man that I have met with a cheerful face and a plentiful board. Have you any income independent of your cure?" "Yes, sir," said the clergyman, "I have; my family would starve on the pittance I receive from the poor people that I instruct. Come with me into

the garden, and I will show you the *stock* that yields me an excellent interest." On going to the garden, he showed the bishop a large range of bee-hives. "There is the bank from which I draw an annual dividend. It never stops payment." Ever after that memorable visit, when any of his clergy complained to the bishop of poverty, he would say to them, "keep bees, keep bees;" and we shall bid our readers adieu with the same advice.

On the Strength of Materials.

[From Brunton's Compendium of Mechanics.]

(Concluded from p. 49.)

STRENGTH OF THE JOURNALS OF SHAFTS.

Lateral Strength.

The Rules in problem 5, of the last article, can be here applied. Mr. Robertson Buchanan, in his Essay on the Strength of Shafts, uses the following rule, which is simple enough, and easy to be remembered; but the above-mentioned rules, are the most correct, and ought to be used on all occasions.

Mr. Buchanan's rule is,—"The cube root of the weight in cwts. is nearly equal to the diameter of the journal."—"*Nearly equal,* —being prudent to make the journal a little more, than less, and to make a due allowance for wearing."

Example.

What is the diameter of the journal of a water wheel shaft, 13 feet long, the weight of the wheel being 15 tons?

By Mr. B.'s rule. $\sqrt[3]{15 \times 20} = 6.7$ or 7 inches diameter.

By Mr. Tredgold's rule.

Weight in the middle. $\left\{ \frac{33600 \times 13}{500} = 873 \quad \sqrt[3]{873} = 9\frac{1}{2} \right.$ inches diameter.

Weight equally distributed. $\left\{ 33600 \times 13 = 436800 \quad \frac{\sqrt[3]{436800}}{10} = 7.65 \right.$ inches.

To Resist Torsion or Twisting.

It is obvious that the strength of revolving shafts are directly as the cubes of their diameters and revolutions; and inversely, as the resistance they have to overcome.

Mr. Robertson Buchanan, in his Essay on the Strength of Shafts, gives the following data, deduced from several experiments, viz. that the fly wheel shaft of a 50 horse power engine, at 50 revolutions per minute, requires to be $7\frac{1}{2}$ inches diameter, and, therefore, the cube of this diameter, which is $= 421.875$, serves as a multiplier to all other shafts in the same proportion; and taking this as a standard, he gives the following multipliers, viz.

For the shaft of a steam engine, water wheel, or any shaft connected with a first power, - - - - - -	400
For shafts in inside of mills, to drive smaller machinery, or connected with the shafts above, - - - - -	200
For the small shafts of a mill or machinery, - - -	100

From the foregoing, the following rule is derived, viz.

The number of horses' power a shaft is equal to, is directly as the cube of the diameter and number of revolutions; and, inversely, as the above multipliers.

Note. Shafts here, are understood as the journals of shafts, the bodies of shafts being, generally, made square.

Example 1.

When the fly wheel shaft of a 45 horse power steam engine, makes 90 revolutions per minute, what is the diameter of the journal?

$$\frac{45 \times 400}{90} = 200 \qquad \sqrt[3]{200} = 5\tfrac{8}{10} \text{ inches diameter.}$$

Example 2.

The velocity of a shaft is 80 revolutions per minute, and its diameter is 3 inches: what is its power?

$$\frac{3^3 \times 80}{400} = 5.4 \text{ horse power.}$$

Example 3.

What will be the diameter of the shaft in the first example, when used as a shaft of the second multiplier?*

$$\frac{5.8}{1.25} = 4.64, \text{ or } \sqrt[3]{\frac{45 \times 200}{90}} = 4\tfrac{6}{10} \text{ inches diameter.}$$

The following is a table of the diameters of shafts, being the first movers, or having 400 for their multipliers.

* The diameters of the second movers will be found by dividing the numbers in the table by 1.25, and the diameters of the third movers, by dividing the numbers by 1.56.

TABLE.

DIAMETERS OF THE JOURNALS OF FIRST MOVERS.

Horses' power.	REVOLUTIONS.									
	10	15	20	25	30	35	40	45	50	55
4	5.5	4.8	4.5	4.	3.7	3.8	3.5	3.3	3.2	3.1
5	5.9	5.1	4.7	4.4	4.1	3.9	3.7	3.6	3.5	3.3
6	6.3	5.5	5.	4.6	4.4	4.1	4.	3.8	3.7	3.6
7	6.6	5.8	5.2	4.9	4.6	4.4	4.2	4.	3.9	3.7
8	6.9	6.	5.5	5.1	4.8	4.6	4.4	4.2	4.1	4.
9	7.2	6.3	5.7	5.5	5.	4.8	4.5	4.4	4.2	4.1
10	7.4	6.6	5.9	5.6	5.2	4.9	4.7	4.6	4.4	4.2
12	7.9	6.9	6.3	5.8	5.6	5.4	5.2	5.	4.8	4.6
14	8.3	7.2	6.7	6.2	5.9	5.6	5.4	5.2	5.	4.7
16	8.7	7.6	7.1	6.6	6.1	5.8	5.6	5.4	5.2	5.
18	9.	7.9	7.5	7.	6.6	6.2	5.8	5.6	5.4	5.2
20	9.3	8.1	7.4	7.2	6.6	6.4	5.9	5.7	5.6	5.4
25	10.	8.5	8.	7.4	7.1	6.8	6.3	6.	5.9	5.6
30	10.7	9.3	8.4	7.9	7.4	7.1	6.9	6.7	6.5	6.3
35	11.4	9.8	8.9	8.4	7.9	7.4	7.1	6.9	6.6	6.5
40	11.7	10.5	9.3	8.8	8.3	7.8	7.4	7.2	6.9	6.7
45	12.	10.6	9.7	9.2	8.7	8.1	7.6	7.4	7.	6.8
50	12.6	11.	10.	9.3	9.	8.5	8.	7.8	7.4	7.3
55	13.4	11.4	10.4	9.8	9.1	8.8	8.4	8.	7.5	7.4
60	13.6	12.	10.8	10.	9.3	9.	8.6	8.2	7.7	7.6
INCHES DIAMETER.										

TABLE CONTINUED.

Horses' power.	REVOLUTIONS.									
	60	65	70	75	80	85	90	95	100	105
4	3.	2.9	2.9	2.8	2.7	2.7	2.6	2.6	2.6	2.5
5	3.3	3.2	3.1	3.	3.	2.9	2.9	2.8	2.8	2.7
6	3.5	3.5	3.4	3.3	3.2	3.2	3.	3.	2.9	2.9
7	3.6	3.6	3.5	3.4	3.4	3.3	3.3	3.2	3.1	3.1
8	3.9	3.8	3.7	3.6	3.5	3.5	3.4	3.4	3.3	3.2
9	4.	3.8	3.7	3.7	3.6	3.6	3.5	3.5	3.4	3.3
10	4.1	4.	3.9	3.8	3.7	3.7	3.6	3.6	3.5	3.4
12	4.4	4.3	4.2	4.1	4.	3.9	3.8	3.8	3.7	3.6
14	4.5	4.4	4.4	4.3	4.2	4.1	4.	4.	3.9	3.8
16	4.8	4.7	4.6	4.5	4.4	4.4	4.3	4.2	4.1	4.
18	5.	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.2
20	5.2	5.1	5.	4.8	4.6	4.6	4.5	4.5	4.4	4.4
25	5.5	5.4	5.3	5.2	5.1	4.9	4.8	4.7	4.6	4.6
30	5.9	5.8	5.7	5.6	5.5	5.3	5.2	5.1	5.	4.9
35	6.3	6.1	5.9	5.7	5.6	5.5	5.4	5.3	5.2	5.2
40	6.6	6.4	6.2	6.	5.9	5.8	5.7	5.6	5.6	5.5
45	6.7	6.5	6.4	6.2	6.1	6.	5.9	5.8	5.7	5.6
50	7.2	6.9	6.8	6.6	6.5	6.4	6.2	6.	5.9	5.8
55	7.3	7.2	7.	6.7	6.6	6.5	6.3	6.2	6.1	6.
60	7.4	7.3	7.2	6.9	6.8	6.8	6.7	6.6	6.4	6.2
	INCHES DIAMETER.									

It is a well known fact, that a cast-iron rod will sustain more torsional pressure, than a malleable iron rod of the same dimensions. —That is, a malleable iron rod will be twisted by a less weight than what is required to wrench a cast-iron rod of the same dimensions.

When the strength of malleable iron is less than that of cast-iron to resist torsion, it is stronger than cast-iron to resist lateral pressure, and that strength is in proportion as 9 is to 14.

From the foregoing, it is easy for the millwright to make the shafts of the iron best suited to overcome the resistance to which they will be subject, and the proportion of the diameters of their journals, according to the iron of which they are made:—for example; what will be the diameter of a malleable iron journal, to sustain an equal weight with a cast-iron journal of 7 inches diameter?

$$7^3 = 343.$$

$$14 : 343 :: 9 : 220\tfrac{1}{2} \text{ now } \sqrt{220.5} = 6.04 \text{ inches diameter.}$$

STRENGTH OF WHEELS.

The arms of wheels are as levers fixed at one end, and loaded at the other, and, consequently, the greatest strain is upon the end of the arm next the axle; for that reason all arms of wheels should be strongest at that part, and tapering towards the rim.

The rule for the breadth and thickness of arms, according to their length and number in the wheel, is as follows: (*See Tredgold's Essay, page* 114.) Multiply the power or weight acting at the end of the arm by the cube of its length; the product of which, divided by 2656 times the number of arms multiplied by the deflection, will give the breadth and cube of the depth.

Example.

Suppose the force acting at the circumference of a spur wheel to be 1600 lbs. the radius of wheel 6 feet, and number of arms 8, and let the deflection not exceed $\frac{1}{10}$ of an inch.

$$\frac{1600 \times 6^3}{2656 \times 8 \times .1} = 163 = \text{breadth and cube of the depth.}$$

Let the breadth be 2.5 inches, therefore $\frac{163}{2.5} = 65.2$, which is equal to the cube of the depth: now the cube root of 65.2 is nearly 4.03 inches; this, consequently, is the depth, or dimension, of each arm in the direction of the force.

Note. When the depth at the rim is intended to be half that of the axes, use 1640 as a divisor, instead of 2656.

The teeth are as beams, or cantilevers, fixed at one end and loaded at the other, the rule applying direct to them, (*See Tredgold's Essay, Art.* 121,) where the length of the beam is the length of the teeth, and the depth the thickness of the teeth. For the better explanation of the rule, the following example is given.

Example.

The greatest power acting at the pitch line of the wheel, is 6000 lbs. and the thickness of the teeth $1\frac{1}{2}$ inch, the length of the teeth being 0.25 feet; it is required to determine the breadth of the teeth.

$$\frac{6000 \times 0.25.}{212 \times 1.5^3} = \frac{1500}{477} = 3.2 \text{ inches the breadth required.}$$

In order that the teeth may be capable of offering a sufficient re-

sistance after being worn by friction, the breadth thus found should be doubled; therefore, in the above example, the breadth should be 6.4, or say, $6\frac{1}{2}$ inches.

Mr. Carmichael* gives the following data, gleaned from experiments, which is, therefore, valuable, and of much use to the practical mechanic.

Rule. Multiply the breadth of the teeth by the square of the thickness, and divide the product by the length; the quotient will be the proportional strength in horses' power, with a velocity of 2.27 feet per second.

Example.

What is the power of a wheel, the teeth of which are 6 inches broad, 1.5 inch thick, and 1.8 inch long, and revolving at the velocity of 3 feet per second?

$$\frac{1.5^2 \times 6}{1.8} = \frac{13.5}{1.8} = 7.5 \text{ strength at 2.27 feet per second.}$$

$$\text{then } 2.27 : 7.5 :: 3 = \frac{7.5 \times 3}{2.27} = 9.91 \text{ horse power.}$$

Rule. The pitch is found by multiplying the thickness by 2.1, and the length is found by multiplying the thickness by 1.2.

Example.

The thickness being 2 inches, what is the pitch and length?

$$2 \times 2.1 = 4.2 \text{ Pitch.}$$

$$2 \times 1.2 \times 2.4 \text{ Length.}$$

Note. The breadth of the teeth, as commonly executed by the best masters, seems to be from about twice to thrice the pitch.

TABLE.

Pitch in Inches.	Thickness in Inches.	Breadth in Inches.	Length in Inches.	Horses' Power at 2.27 feet per Sec.	H. P. at 3 feet per. Sec.	H. P. at 6 feet per Sec.	H. P. at 11 feet per Sec.
4.2	2.	8.	2.40	13.33	17.61	35.23	64.6
3.99	1.9	7.6	2.28	13.03	15.90	31.80	58.30
3.78	1.8	7.2	2.16	10.80	14.27	28.54	52.32
3.57	1.7	6.8	2.04	9.63	12.72	25.54	46.68
3.36	1.6	6.4	1.92	8.53	11.27	22.54	41.32
3.15	1.5	6.	1.80	7.50	9.91	19.82	36.33
2.94	1.4	5.6	1.68	6.53	8.63	17.26	31.64
2.73	1.3	5.2	1.56	5.63	7.44	14.88	27.28
2.52	1.2	4.8	1.44	4.80	6.34	12.68	23.24
2.31	1.1	4.4	1.32	4.03	5.32	10.64	19.54
2.10	1.	4.	1.20	3.33	4.40	8.81	16.15
1.89	.9	3.6	1.08	2.70	3.57	7.14	13.09
1.68	.8	3.2	.96	2.13	2.81	5.62	10.33
1.47	.7	2.8	.84	1.63	2.15	4.30	7.88
1.26	.6	2.4	.72	1.20	1.59	3.18	5.83
1.05	.5	2.	.60	.83	1.10	2.20	4.03

* See Robertson Buchanan on the Teeth of Wheels.

VELOCITY OF WHEELS.

Wheels are for conveying motion to the different parts of a machine, at the same, or at a greater or less velocity, as may be required.—When two wheels are in motion, their teeth act on one another alternately, and, consequently, if one of these wheels has 40 teeth, and the other 20 teeth, the one with twenty will turn twice upon its axis, for one revolution of the wheel with 40 teeth.—From this the rule is taken, which is,—as the velocity required is to the number of teeth in the driver, so is the velocity of the driver to the number of teeth in the driven.

Note. To find the proportion that the velocities of the wheels in a train should bear to one another, subtract the less velocity from the greater, and divide the remainder by the number of one less than the wheels in the train; the quotient will be the number rising in arithmetical progression, from the least to the greatest velocity of the train of wheels.

Example 1.

What is the number of teeth in each of three wheels to produce 17 revolutions per minute, the driver having 107 teeth, and making 3 revolutions per minute?

$$\frac{17 - 3 = 14}{3 - 1 = 2} = 7,$$ therefore, 3 10 17 are the velocities of three wheels.

$$\text{By the rule.}\begin{cases} 10 : 107 :: 3 : 32 = \dfrac{107 \times 3}{10} = 32 \text{ teeth.} \\ 17 : 32 :: 10 : 19 = \dfrac{32 \times 10}{17} = 19 \text{ teeth.} \end{cases}$$

Example 2.

What is the number of teeth in each of 7 wheels, to produce 1 revolution per minute, the driver having 25 teeth, and making 56 revolutions per minute?

$$\frac{56 - 1 = 55}{7 - 1 = 6} = 9,$$ therefore, 56 46 37 28 19 10 1, are the progressional velocities.

46 :	25 : :	56 :	30	Teeth.
37 :	30 : :	46 :	37	——
28 :	37 : :	37 :	49	——
19 :	49 : :	28 :	72	——
10 :	72 : :	19 :	137	——
1 :	137 : :	10 :	1370	——

It will be observed that the last wheel, in the foregoing example, is of a size too great for application; to obviate this difficulty, which frequently arises in this kind of training, wheels and pinions are used, which give a great command of velocity.—Suppose the velocities of last example, and the train only of 2 wheels and 2 pinions.

$$\frac{56 - 1 = 55}{4 - 1 = 3} = 18,$$ therefore, 56 19 1, are the progressional velocities.

19 : 25 : : 56 : 74 = teeth in the wheel driven by the first driver, and 1 : 10 : : 19 : 190 = teeth, in the second driven wheel, 10 teeth being in the driving pinion.

25 drivers 74 driven.
10 —— 190 ——

The following is a table of the radii of wheels, from ten to three hundred teeth, the pitch being 2 inches.

The radius for any other pitch may be found by the following analogy:—as two inches is to the radius in the table, so is the new pitch to the new radius.

TABLE.

No. of Teeth.	Radius in Inches.	No. of Teeth.	Radius in Inches.	No. of Teeth.	Radius in Inches.	No. of Teeth.	Radius in Inches.
10	3.236	46	14.654	82	26.108	118	37.565
11	3.549	47	14.972	83	26.426	119	37.883
12	3.864	48	15.290	84	26.741	120	38.202
13	4.179	49	15.608	85	27.063	121	38.520
14	4.494	50	15.926	86	27.381	122	38.838
15	4.810	51	16.244	87	27.699	123	39.156
16	5.126	52	16.562	88	28.017	124	39.475
17	5.442	53	16.880	89	28.336	125	39.793
18	5.759	54	17.198	90	28.654	126	40.111
19	6.076	55	17.517	91	28.972	127	40.429
20	6.392	56	17.835	92	29.290	128	40.748
21	6.710	57	18.153	93	29.608	129	41.066
22	7.027	58	18.471	94	29.927	130	41.384
23	7.344	59	18.789	95	30.245	131	41.703
24	7.661	60	19.107	96	30.563	132	42.021
25	7.979	61	19.425	97	30.881	133	42.339
26	8.296	62	19.744	98	31.200	134	42.657
27	8.614	63	20.062	99	31.518	135	42.976
28	8.931	64	20.380	100	31.836	136	43.294
29	9.249	65	20.698	101	32.155	137	43.612
30	9.567	66	21.016	102	32.473	138	43.931
31	9.885	67	21.335	103	32.791	139	44.249
32	10.202	68	21.653	104	33.109	140	44.567
33	10.520	69	21.971	105	33.427	141	44.885
34	10.838	70	22.289	106	33.746	142	45.204
35	11.156	71	22.607	107	34.064	143	45.522
36	11.474	72	22.926	108	34.382	144	45.840
37	11.792	73	23.244	109	34.700	145	46.158
38	12.110	74	23.562	110	35.018	146	46.477
39	12.428	75	23.880	111	35.337	147	46.795
40	12.746	76	24.198	112	35.655	148	47.113
41	13.064	77	24.517	113	35.974	149	47.432
42	13.382	78	24.835	114	36.292	150	47.750
43	13.700	79	25.153	115	36.611	151	48.068
44	14.018	80	25.471	116	36.929	152	48.387
45	14.336	81	25.790	117	37.247	153	48.705

TABLE CONTINUED.

No. of Teeth.	Radius in Inches.	No. of Teeth.	Radius in Inches.	No. of Teeth.	Radius in Inches.	No. of Teeth.	Radius in Inches.
154	49.023	191	60.800	228	72.577	265	84.354
155	49.341	192	61.118	229	72.895	266	84.673
156	49.660	193	61.436	230	73.214	267	84.991
157	49.978	194	61.755	231	73.532	268	85.309
158	50.296	195	62.073	232	73.850	269	85.627
159	50.615	196	62.392	233	74.168	270	85.946
160	50.933	197	62.710	234	74.487	271	86.265
161	51.251	198	63.028	235	75.805	272	86.582
162	51.569	199	63.346	236	75.123	273	86.900
163	51.888	200	63.665	237	75.441	274	87.219
164	52.206	201	63.983	238	75.760	275	87.537
165	52.524	202	64.301	239	76.078	276	87.855
166	52.843	203	64.620	240	76.397	277	88.174
167	53.161	204	64.938	241	76.715	278	88.462
168	53.479	205	65.256	242	77.033	279	88.810
169	53.798	206	65.574	243	77.351	280	89.129
170	54.116	207	65.893	244	77.670	281	89.447
171	54.434	208	66.211	245	77.988	282	89.765
172	54.752	209	66.529	246	78.306	283	90.084
173	55.078	210	66.848	247	78.625	284	90.402
174	55.389	211	67.166	248	78.943	285	90.720
175	55.707	212	67.484	249	79.261	286	91.038
176	55.026	213	67.803	250	79.580	287	91.357
177	55.344	214	68.121	251	79.898	288	91.675
178	56.662	215	68.439	252	80.216	289	91.993
179	56.980	216	68.757	253	80.534	290	92.312
180	57.299	217	69.075	254	80.853	291	92.630
181	57.617	218	69.394	255	81.171	292	92.948
182	57.935	219	69.712	256	81.489	293	93.267
183	58.253	220	70.031	257	81.808	294	93.585
184	58.572	221	70.349	258	82.126	295	93.903
185	58.890	222	70.667	259	82.444	296	94.222
186	59.209	223	70.985	260	82.763	297	94.540
187	59.527	224	71.304	261	83.081	298	94.858
188	59.845	225	71.622	262	83.399	299	95.177
189	60.163	226	71.941	263	83.717	300	95.495
190	60.482	227	72.258	264	84.038		

On some kinds of Fulminating Powder inflammable by Percussion, and their use in Fire-arms. By P. W. Schmidt, Lieutenant in the Prussian service.*

A powder, inflammable by percussion, has been used for some years past, especially in fowling-pieces. The following formulæ

* From Schweigger's Journal, Band xi. p. 66.

have been given for the preparation of this powder, the principal ingredient of which is chlorate of potash.

1. 100 parts of chlorate (oxy-muriate) of potash, 12 parts of sulphur, and 10 parts of charcoal are intimately mixed. The grains are produced by forcing the soft paste through a sieve.

2. 100 parts of chlorate of potash, 42 parts of saltpetre, 36 parts of sulphur, and 14 parts of lycopodium.

These are the usual ingredients that have hitherto been mixed with the chlorate of potash for the purpose of making priming powder. The guns, however, with which this powder is used, are very various in their construction. In some it primes itself by means of the mechanism of the lock, passing, on being cocked, into a small conical recess, which communicates with the touch-hole; in others, it is put in previous to every shot. In the former kind of guns a quantity of powder sufficient for a certain number of shots is kept in a recess attached to the lock, called a magazine; and the locks (which were invented in England by Mr. Forsyth) are called magazine locks.

In some guns the stroke of the cock, which is in the shape of a hammer, falls immediately on the fulminating powder strewed in the above recess. In order to protect the powder from wet, small balls of it were covered over with wax, and placed sometimes in the conical recess, and at others fixed to the cock itself. In both instances the ball was kindled in the recess just mentioned, by means of the percussion.

Besides these, other contrivances have been used for the purpose of igniting this kind of powder; yet they have all their defects, and offer so many difficulties in practice as to have prevented their general introduction.

Latterly, they have contrived in Germany to fix the powder in a small case of very thin copper foil, for the purpose of keeping it dry; and for that purpose a cylinder is screwed into the body of the gun instead of the touch-hole, and rests, for the sake of greater support, on the plate of the lock, instead of resting on the pan. The inner space of the cylinder is filled, in loading, with the same powder as that of the charge. The igniting-cap, at the bottom of which is the detonating powder, is, previous to firing, turned up on the cylinder. In this cylinder is a small round aperture, leading to the inner space of the cylinder. On the trigger being pulled, the cock strikes the igniting-cap, and the fulminating powder is kindled by the blow, flows through the aperture, inflames the shot, and breaks the igniting-cap.

Mr. Wright seems to have taken great pains with the subject.* He recommends, for the igniting-caps, to use fulminating mercury, saying that sportsmen had justly complained of the powder made of chlorate of potash, since it soon produces the oxidation of the barrel and touch-hole, and the charcoal which remains after the firing, rendering them unfit for use. The advantages of his new powder he enumerates as follows: it does not make the gun rusty so soon as the

* Mr. Wright's paper will be found in Phil. Mag. vol. lxii. p. 203.

other; it produces neither dirt nor moisture; it is not so liable to explode as the other powder, and if it does explode, its effects are less destructive, inasmuch as its power does not extend so far.

The following is his mode of preparation:

"I place two drachms of quicksilver in a Florence flask, and pour six drachms (measure) of *pure* nitric acid on the mercury; this I place in a stand over a spirit lamp, and make it boil till the quicksilver is taken up by the acid; when nearly cool, I pour it on an ounce (measure) of alcohol in another flask: sometimes immediate effervescence ensues, with the extrication of nitrous æther; and often I have been obliged to place the mixture over the lamp, till a white fume begins to rise, when the effervescence follows. I suffer the process to continue (removing the lamp) till the fumes assume a reddish hue; when I pour water into the flask, and the powder is found precipitated to the bottom; I pour off and add fresh water, permitting the powder to subside each time before the water is poured off, so as to free the substance as much as possible from the acid, and then I pour it on a piece of filtering paper, and place the powder in an airy room to dry. It should be kept in a corked (not stoppered) bottle."

For the filling of the caps, he makes use of an ivory rod, which has a scoop at one end for the purpose of receiving the powder, and at the other is cut flat; with this he puts in as much fulminating mercury as will cover the bottom; he then dips the flat end into a strong tincture of benzoin, and rubs this substance gently about the case; by which means the powder is set fast and covered as with a varnish.

Professor Schweigger, speaking of these kinds of experiments in his chemical lectures, noticed the difficulty of kindling gunpowder by the mere admixture of such substances, as has been shown in a criminal investigation that took place at Munich a few years ago. A box filled with gunpowder was sent to an individual; enclosed were fulminating papers, which were to inflame on the box being opened. Fortunately, however, the murderous design was frustrated; for although the papers exploded, they did not kindle the powder. The assassin was discovered and punished. M. Gehlen, who had been examined at the trial, was led by the circumstance to make several experiments for the purpose of kindling gunpowder by means of Brugnatelli's fulminating silver, but they all failed.

It seems that in England, too, difficulties had been found in igniting gunpowder with fulminating mercury; for Mr. Wright observes, "if any one doubts the practicability of firing gunpowder by means of fulminating mercury, by procuring a percussion-gun, he may try the experiment and be fully satisfied."

Professor Schweigger having, therefore, requested me to try some experiments on this subject, especially with fulminating silver, I made them in the chemical laboratory of our university, and the following were the results.

I. Fulminating silver was prepared in the usual way; five drachms of fuming nitric acid, and five of alcohol were poured over one drachm of fused nitrate of silver. When the effervescence and solution were

complete, water was added. The precipitate of fulminating silver was filtered off, and all the remaining acidity washed from it with water. The liquid which had passed through the filter gave with muriatic acid a copious precipitate of chloride of silver. The fulminating silver, which was of a whitish tint, was now subjected to the following experiments:

1. When damp, it ignited very rarely, and only by a strong blow. When dry, it explodes easily, and with a much slighter blow.

2. When touched with sulphuric acid, it exploded equally strongly, whether damp or dry.

3. Damp or dry, it exploded in the fire.

4. The substance which remained after the ignition, was of a bluish brilliant hue and a disagreeable metallic taste. I could gather but little, which, dissolved in water, produced a faint red tint on litmus paper.

5. I failed in several attempts to ignite gunpowder with the fulminating silver. I therefore put quantities of the size of a small pin's head, into some copper boxes, fastening it in some with tincture of benzoin, in others with a solution of gum arabic in water; and others I tried to press on the bottom without any other aid. I applied them to guns prepared for the use of igniting-caps, and thus kindled the gunpowder with incredible swiftness. The series of experiments thus made in the presence of Professor Schweigger, leaves no doubt that fulminating silver will easily ignite gunpowder, if it be secured against a rapid dispersion on exploding.

II. The fulminating mercury was prepared in the manner prescribed by Mr. Wright. But I must observe that the experiment only succeeded by the application of fuming nitric acid. The fulminating mercury, when obtained, was washed till every particle of acidity had disappeared from it. It was then submitted to the following experiments:

1. When dry, it exploded like fulminating silver, and with a much slighter blow than required for the powder made of chlorate of potash. Thus it would appear as if the fulminating quicksilver had not in this respect the advantage over the igniting powder made with the salt just named.

2. When perfectly dry only, it could be ignited with sulphuric acid.

3. In the fire it exploded, both wet and dry.

4. The substance remaining after the explosion, had a bluish brilliant tint and a bitter, acid, metallic taste. With a small quantity dissolved in water, litmus paper was slightly reddened. I made no further investigation, inasmuch as the examination of the acids of fulminating metals, before and after the explosion, was not my object; especially since Dr. Liebig has lately published a series of very interesting experiments, the repetition of which would require very extensive labour.* Liebig calls those acids fulminic acids, which

* Vide *Ann. de Chim. et de Phys.* part xxiv. p. 294, or the translation in Gilbert's *Annalen der Phys.* part. lxxv. p. 393—422. Mr. Liebig found that Brug-

being the property of all metals, he distinguishes into silver and mercury fulminic acids, &c.

The great advantages, however, of the fulminating quicksilver for igniting powder, so extolled by Mr. Wright, I did not find confirmed, although I proceeded to fill copper caps, as I had done with the detonating silver, which all ignited the charge.

III. I also submitted to experiment the first-named mixture, principally consisting of chlorate of potash; and found

1. That it exploded only by a hard blow. Its effects were much less than those of the detonating silver, or quicksilver. Mr. Wright, indeed, says the contrary of the latter; it seems, therefore, that I used a better kind of fulminating mercury; but for that very reason I must give the chlorate of potash the preference for practical use.

2. In the fire it puffed away like gunpowder.

3. The substance remaining after the explosion is blackish and dusty, and contains less of acidity than that left by the quicksilver. Thus, and indeed from all my experiments, it is evident that it oxidizes the iron less than the fulminating mercury. Moisture is also left by the latter; and the charcoal left by the mixture of chlorate of potash, after kindling a copper cap filled with it, is very unimportant:—therefore this mixture is preferable as an igniting powder. This is also the reason why the manufacturers no longer use the fulminating quicksilver. I know one who makes and fills, weekly, several thousands of copper caps, for which he uses the chlorate mixture, the preparation of which is both less expensive and less dangerous than that of the fulminating quicksilver. There is another circumstance attending this mixture; in filling the caps, it

natelli's detonating silver was dissolved in lime-water or solutions of the caustic alkalies, whereby 31,25 per cent of oxide of silver was deposited. They produce peculiar salts, called *fulminates,* which explode with great violence. These salts are dissolved by nitric acid, sulphuric acid, and acetic acid; the silver fulminic acid contained in them, and so difficult to be dissolved, is deposited; and by heating a solution of fulminate of lime to the boiling point, and adding a moderate quantity of nitric acid, is deposited, on cooling, at the bottom of the vessel, in the shape of long white crystals. This acid may be easily dissolved in boiling water; from which it crystallizes again in cooling, has a disgusting metallic taste, and reddens litmus paper: but it cannot subsist of itself without combination with a metal; and in the same manner as there are prussiates of iron, copper, silver and gold, so the fulminic acid combines with silver, quicksilver, copper, iron, zinc, &c. into proper fulminates, which again form different combinations with the bases *e. g.* potash, soda, barytes, strontian, lime, &c. Thus, for instance, silver-fulminate of potash consists of 35,03 parts of silver-fulminic acid and 14,92 of potash; silver-fulminate of soda, of 88,66 parts of silver-fulminic acid and 11,34 of alkali. When cooling, Berthollet's detonating silver forms granular shining white crystals. One part of this salt makes as violent a report as three parts of Howard's (Brugnatelli's) fulminating silver. With magnesia the silver-fulminic acid combines in two ways; one combination is a simple decrepitating, not detonating, insoluble powder, of a rosy tint; the other forms white capillary crystals, and explodes very loudly. The first combination was used for the analysis of fulminic acid in the dry way; in which the fulminating silver was evinced to consist of 32,22 of oxygen, 3,22 of hydrogen, 11,28 of azote, 9,68 of carbon, and 41 of silver.

will sometimes happen that the quantity put in is doubled, which I find is of no injurious consequence with this mixture; but might endanger the person firing with the fulminating mercury, as the cap will burst too violently.

With respect to the power of igniting the charge, the different kinds of powder which I have compared are equally effectual.

IV. I submitted the mixture of chlorate of potash mentioned above to the following experiments.

1. That part only ignited which was struck, without igniting that lying around it.

2. In the fire it burns away with noise.

3. I placed it in the usual way in copper caps, but could not ignite a charge with them. The cause of this may be explained by the construction of the locks, with reference to the properties of this detonating powder. That part of the cap situated just above the opening of the cylinder remains, as the blow cannot fall on it unignited, as shown by the experiment No. 1. But the communication of the ignited part with the charge, is prevented by the manner in which the cock strikes the cap. In guns in which such powder is used for igniting, it lies as above stated, in small balls in a conical aperture. Here it is nearly all ignited by the striking of the cock, and must of necessity flow inwards, every other way of escape being shut up.

In conclusion:—I have to add that the method of filling the caps recommended by Mr. Wright is not only laborious, but even dangerous. How are manufacturers to employ that method when they have to fill several thousands a week? I have made various trials, and the following process seems to me to be the best.

Pour some adhesive solution or tincture over the powder, and mix it into a stiff kind of liquid. Take with a brush or a stick a large drop of it, and apply it against the bottom of the cap.

This method is both quick and free from danger; whilst on filling with the dry detonating powder, the least careless touch may produce an explosion.

In order to prevent the corrosion of the cylinder, and its becoming useless by the formation of sulphuret of iron (an evil very common with iron touch-holes, and caused more by the action of the gun-powder than by that of the igniting substance,) the inside of the cylinder should be lined with a metal which will neither oxidate nor easily combine with the ingredients of the powder.—[*Philos. Mag.*

Manufacture of Sugar of Lead.

This salt is an object of considerable interest on account of the great use made of it in calico-printing, as well as in some other arts. In the calico-printing business, it is in reality one of the most useful preparations; or according to the French term, which many of the English writers wish to naturalize among us, mordant, or biter-in.

It is probable that in time it will be less used than at present; and that acetate of lime, which is a much cheaper salt, and which also decomposes alum, and changes its base into an acetate, will be preferred.

The French complain much that this change is likely to take place; because the manufacture of sugar of lead brings into use the inferior wines produced in some of their provinces, especially those which will not keep for any time: but as a greater consumption has taken place, and the pyroligneous acid, or vinegar of wood, presents greater advantages, these two products are become reciprocal advantages.

Formerly this acetate of lead was made from vinegar and blue lead: that is to say, common metallic lead: some manufacturers, however, used white lead for this purpose; but as this is usually mixed with more or less whiting, a portion of the acid was taken up by this calcareous earth; the acetate of lime thus produced, augmented the quantity of mother water, and was injurious to the crystallization.

The process formerly used was this; as the lead is not attacked by the acid while it retains its metallic form, cast lead was cut in pieces by chisels, for milled lead was considered as too close; these cuttings were put into pans, and a small quantity of vinegar was poured on them, but not sufficient to cover them. The part which was not sunk beneath the acid becomes oxidized in a short time; and as the cuttings were stirred several times a day, in order to change the surfaces exposed to the air or to the acid, the oxide was gradually dissolved in the vinegar. When the acid was saturated, the liquors in the several pots were poured into a tinned copper boiler, and boiled down one-third; the liquor was then filtered, and boiled down again, until on trial it appeared fit for crystallizing; it was then decanted and set by to crystallize; the first crop was large and white needle-like crystals; but the mother waters, by further evaporation, yielded coloured crystals.

This method has given place to another, which is far superior, and founded upon an exact knowledge of the nature and proportion of this salt.

It is well known that, according to the best analysis, the acetate of lead is composed in round numbers of 58 parts, in 100 oxide of lead, 26 of acid, and 16 of water; of course, the saturating power of the pyroligneous acid intended to be employed must be examined, in order to determine how much of it answers to 26 parts of the dry acid. When this acid is at 40 degrees of the acidemeter, it generally requires 68 lbs. of it to be poured on 58 lbs. of litharge. The solution takes place immediately, and is so quickly made, that a considerable heat is produced, which retains the sugar of lead in solution; but a little fire is usually given, and some water added, to keep up this solution until the liquor has become clean, and it is then poured into crystallizing pans.

The crystals, which usually weigh 75 lbs. are produced in about thirty-six hours; they are drained and carefully dried. The mother water, which contains about 25 lbs. of the sugar, by evaporation

yields great part of its contents; but the crystals are by no means so fine as the former. When the mother waters no longer yield crystals, they are mixed with salts of soda, when a carbonate of lead falls down, and acetate of soda remains in solution. The carbonate of lead may be used instead of litharge in future operations.

It will be found preferable at first to add the mother water to the acid and litharge, and thus near 100 lbs. of good sugar of lead will be obtained instead of 75 lbs. by the first crystallization; but this method cannot be continued for any time, as the liquor will become greasy, the crystallization will be hindered, and the sugar of lead becomes difficult to drain, so that it is then necessary to abstain from adding the mother water any longer to the solution, and to decompose it by salt of soda.

The acid ought to be pure, and particularly free from tar and sulphurous acid; the tar would discolour the sugar of lead, and the sulphurous acid produce an insoluble precipitate of sulphate of lead.

The boiling solution may be brought to various densities by adding more or less water; and as this difference produces some variety in regard to the crystals, the manufacturer, by a little observation, may suit the taste of his customers.

To obtain a very white sugar of lead, the metal or litharge should have no admixture of copper, as is usual in French lead, and German litharge. Its effects may, however, be obviated, by putting a few plates of lead into the boiler. But some manufacturers do not wish to separate the copper, because it gives the sugar of lead a slight bluish tinge, which pleases the eye of many of the buyers.

In this solution of the litharge in the acid there remains a very small residuum, which ought not to be thrown away; but when a quantity of it is collected, it may be treated as an ore of silver, as it is composed of that metal, united with oxide of copper, of lead, and some earthy substances.

It is a great advantage in this manner of forming sugar of lead, by means of strong pyroligneous acid, that it is not necessary to evaporate the solution for the purpose of crystallizing it, as was necessary when vinegar was used; for the solution is decomposed by being boiled, and part of the sugar of lead is changed into white lead, and of course, separates in form of powder.—[*Lond. Mech. Jour.*

Observations on the use of Cast Iron, &c. *By* D. TREADWELL, ESQ. Engineer.

[From the Boston Journal of Science.]

THE extensive use now made of cast iron, and that for purposes to which, but a few years ago, it was not thought of applying it, renders every investigation of its properties, and the modes of manufacturing it, important. This material, instead of being now confined in its use to a few culinary vessels and coarse implements, is not only used, to the exclusion of almost every thing else, for machinery, but houses, bridges, roads, and even vessels have been constructed of

it. Circumstances in England, no doubt, favour this extensive use much more than they do in this country. Coal and iron ore are there abundant, and wood is scarce and dear; while in New England we have no good mineral coal, and our forests of timber are yet extensive.

The use of cast iron for machines, has, however, become very general in this country. Without it the inventions of the present age could never have been carried into effect. A machine constituted of wood, subject to constant swelling and shrinking and warping with every change of the atmosphere, is always liable to derangement. Indeed it can be said to be hardly capable of preserving its identity; while castings undergo no change of figure, and their trifling change of magnitude, by the variation of temperature, is a matter of small moment.

A great deal yet remains to be done to improve the quality of castings in this country, but the demand for them, such as they are, is yet too great for us to expect the furnace owners and masters to give much attention to experiments for this purpose. The perpendicular mode of casting is very far from common at the furnaces in this vicinity, although it undoubtedly possesses advantages which should lead to its universal adoption. The strength of a bar, as has been ascertained by experiment, cast perpendicularly, being to that of one cast horizontally as 1218 is to 1166, while it is much less liable to air bubbles and imperfections of that kind, which render abortive the skill and calculations of the machinist. This superiority is not, as might be supposed from the terms employed, the effect of mere position, but of the pressure of the upright column; and if this is increased by a weight of extraneous metal, the casting is still more likely to be sound. This principle has lately been carried to the extent of compressing the fluid casting by mechanical means.

Iron has usually been divided into three kinds, the white, gray, and black; but as these pass into each other in every degree, it often happens that some castings do not bear the character of any one of the above kinds more than another. The white iron is hard and brittle, and it does not seem to be well understood to what this is to be attributed; while the black is soft and tender, and bears all the marks of containing too great a quantity of carbon. The gray iron, or gun metal, as it is sometimes called, is superior for almost every purpose; it is sufficiently soft to yield to the file, and is much stronger than either of the other kinds.

Cast iron, when used in machines or for buildings, should never be subjected to a weight or pressure which will produce a permanent alteration of its figure, or a *set*, as it is called by the workmen. As this can only take place from a change of the relation which the ultimate particles have to each other, small additions to a force which is sufficient to produce this change, will be sufficient to increase it until the relation is destroyed altogether. Although this may be taken as a principle, yet there is some limit in its application, depending on the shape and size of the bar, the kind of iron, and the direction of the force. It seems true of some bodies, particularly

those of a crystalline, or vitreous structure, that if strained, or if their particles are once separated beyond a certain point, the separation becomes complete. This point corresponds with that of their power to recover their former relations or distances; or the elastic power of the body. In these no permanent alteration of figure can be produced, for a fracture is the consequence of any force which destroys the elastic power. The hard kind of iron approaches this structure, and there is one considerable advantage in using it, which is, that it breaks immediately, if it break at all. Whereas, with the softer kinds, which will bear a permanent alteration of figure, the fracture may not take place until the force has continued to operate some time. But if a force be applied to this kind of iron, sufficient to produce such alteration, and be continued for a long time; or if the direction of it be constantly changing, as is often the case in machines, a fracture will at length be the result. Much, however, depends on the shape of the bar, and the direction of the force; where that direction is constant. As in a bar to which the force is applied transversely, if the iron be soft, the particles can undergo some change in distance beyond their elastic force, without losing their cohesive attraction. In this case those that are situated in the middle of the bar do not undergo any strain until the bar is somewhat curved; when an additional force is sustained by those particles as this curvature is produced, and before the particles situated outside are strained to the fracturing point. But in cases where the direction of the fracture must be at a right angle to the direction of the force, the principle, first stated, that the force applied should not be sufficient to produce a permanent change of figure, may be taken as true. This seems like going too much into the dark abyss of ultimate atoms; but as the facts above stated will be acknowledged, we hope to be excused for the manner in which we have connected them.

In forming castings to bear a transverse strain, it is common to increase the depth to equal several times the breadth; it having been generally understood that the strength is as the square of the depth multiplied into the breadth. But by the experiments of Mr. Rennie, (Phil. Trans. part 1st, 1818,) this rule was not found to hold in a bar of the depth of 4 inches, and the breadth of $\frac{1}{4}$ of an inch, although it held nearly up to this proportion; and that gentleman thinks it evident that the system of deepening has been carried nearly to its limits.

Experiments on the absolute strength of cast iron have been made by several individuals, philosophers as well as engineers. Those of Mr. Rennie, (Phil. Trans. 1818,) and some by Mr. Tredgold, an account of which has lately been published, are deserving of considerable attention. Mr. Rennie's experiments were made with an apparatus well calculated to give correct results. They show the power of iron to resist compression; its power to resist a twisting force; its tenacity when the force is applied to the bars in the direction of their axis, and when applied at right angles to that direction.

His experiments to find the power of iron in resisting compression, gave the following results. Cubes of $\frac{1}{8}$ of an inch, taken from the

middle of a large block, were crushed with a weight of 1440 lb. And what may seem somewhat anomalous, in several trials on specimens having the same area as the preceding, but an increased height, the force required to crush them was increased. Cubes of $\frac{1}{4}$ of an inch were not crushed with a force less than 10,351 lb. on an average. As might be expected, the power of resistance is not as the area, but advances by a more rapid progression.

Mr. Rennie relates but two experiments on cast iron to ascertain its power to sustain weight, when directly suspended from the ends of bars. These were made with bars of $\frac{1}{4}$ of an inch area, and gave a mean of 1193 lb. equal to 19,088 lb. per inch. By the experiment of Muschenbroëk a bar of 1 inch area will sustain 63,286 lb. Mr. Rennie found that bars of $\frac{1}{4}$ of an inch square, having one end fixed in a vice, and a lever three feet in length, applied in a proper manner to twist them, were capable of sustaining about 9 lb. on the end of the lever. His experiments on the strength of bars to resist a force applied transversely, gave the following results. A bar 1 inch square, with supports 2 feet 8 inches apart, broke under a weight of 1086 lb. With the supports 1 foot 4 inches apart, a bar of the same size broke under 2320 lb. A bar 2 inches deep, $\frac{1}{2}$ an inch thick, 2 feet 8 inches long, broke with 2185 lb.; and, with the supports 1 foot 4 inches apart, it was again broken with 4508 lb. Triangular prisms, a cross section of which contained the same area as the foregoing pieces, were fractured with 1437 lb. when one of the angles was placed uppermost, and with 840 lb. when the angle was down, the supports in both cases being 2 feet 8 inches distant. Bars 3 inches deep and $\frac{1}{3}$ of an inch thick, and 4 inches deep and $\frac{1}{4}$ of an inch thick, required weights of 3588 lb. and 3979 lb. respectively to fracture them, when the supports were 2 feet 8 inches apart. Such are some of the experiments of Mr. Rennie. He also repeated the paradoxical experiment of Emerson, and found it true, that in triangular prisms, where the force is intended to act on one of the sides, the prism becomes stronger by having the portion containing its opposite angle cut away. That is, a part is stronger than the whole.

Mr. Tredgold's work, of which we have before spoken, is of a less experimental character than might be desired. He has, however, noticed some of the experiments of Mr. Rennie, and has given an account of others made by several different persons.

Mr. Tredgold has calculated two tables, the first showing the weight that bars of cast iron, of different magnitudes, will bear, without producing a deflexion of curvature of more than $\frac{1}{40}$ of an inch for each foot in length. This table was calculated from the equation $a\,W\,L^2 = B\,D^3$, in which W is the weight in pounds, L the length in feet, and B the breadth, and D the depth of the bar, in inches. The value of a was found by the following mode of investigation. Mr. Tredgold measured the deflexion of several loaded bars, and denoting it by d inches, he took the proportion d: $W :: \frac{L}{40} : \frac{W L}{40\,d}$ and putting this for W in the former equation it becomes $\frac{a\,W\,L^3}{40\,d} = B\,D^3$ and $a = \frac{40\,B\,D^3\,d}{W\,L^3}$ and substituting the numbers fur-

nished by an experiment we have $\frac{40 \times 1 \times 1 \times 1}{971 \times 27} = .00152$. He considers this too high a value, and as other experiments furnished it lower, he uses .001.*

The second table in this work shows, by inspection, the weight which cast iron beams or bars of 1 inch in breadth, and of different lengths and depths, will bear without destroying the elastic force. These loads are set down at about one-third of the load which would be required to produce immediate fracture, and the strength of equal lengths are founded on the rule of the square of the depth by the breadth.

Mr. Tredgold has taken it for a truth, "that while the force is within the elastic power of the material, bodies resist extension and compression with equal forces." As this seems not only to require proof, but to be in contradiction to many experiments, and as a great many of his calculations were founded on this as an axiom, we can have no confidence in the results of them.

We shall end this paper by a statement of the comparative power of a few different materials to sustain weights by suspension, according to Mr. Rennie's experiments.

	lbs.
1-4 inch cast iron bar, horizontal, sustained - -	1166
1-4 inch cast iron bar, vertical, - - - - -	1218
1-4 inch cast steel previously tilted - - - - -	8391
1-4 inch blister steel, reduced per hammer, - -	8322
1-4 inch shear steel do. do. - - -	7977
1-4 inch Swedish iron do. do. - - -	4504
1-4 inch English iron do. do. - - -	3492
1-4 inch hard gun metal - - - - -	2273
1-4 inch wrought copper - - - - - -	2112
1-4 inch cast copper, - - - - - -	1192
1-4 inch fine yellow brass, - - - - - -	1123
1-4 inch cast tin, - - - - - - -	296
1-4 inch cast lead, - - - - - - -	114

An Account of the Fire of St. Elmo. Extracted from a paper in the Edinburgh Philosophical Journal.

In the month of June, 1808, passing from the Island of Ivica to that of Majorca, on board a Spanish polacca ship, fitted as a cartel, and manned by about thirty ruffians, Genoese, Valencians, and Catalonians; a fine southerly gale, by seven in the evening, brought us within six or seven leagues of the anchorage in Palma Bay.

* Any of the results comprised in this table may be found by the practical man, by multiplying the cube of the depth of any bar in inches, by the breadth in inches, and dividing this product by the square of the length in feet. If this quotient be again multiplied by 1000, the product is equal to the number of pounds which the bar will sustain, without a deflexion of more than 1-40th of an inch to each foot, according to Mr. Tredgold.

About this time, the sea-breeze failing us astern, was shortly succeeded by light and baffling breezes off the land. No sooner had the setting sun withdrawn his golden beams from the tops of the lofty hills, which rise to the westward of the town, than a thick and impenetrable cloud, gathering upon the summit of Mount Galatzo, spread gradual darkness on the hills below, and extended at length a premature obscurity along the very surface of the shore. About nine, the ship becalmed, the darkness was intense, and rendered still more sensible by the yellow fire that gleamed upon the horizon to the south, and aggravated by the deep-toned thunder which rolled at intervals on the mountain, accompanied by the quick rapidity of that forked lightning, whose eccentric course, and dire effects, set all description at defiance. By half past nine, the hands were sent aloft to furl top-gallant-sails, and reef the top-sails, in preparation for the threatening storm. When retiring to rest, a sudden cry of St. Elmo and St. Ann, was heard from those aloft, and fore and aft the deck. An interpreter called lustily down the hatchway, that St. Elmo was on board, and desired me to come up. A few steps were sufficient, and, to my great surprise, I found the top-sail-yards deserted, the sails loose, and beating in the inconstant breeze, the awe-struck and religious mariners, bare-headed, on their knees, with hands uplifted, in voice and attitude of prayer, in earnest and muttering devotion to St. Elmo or St. Ann, according to the provincial nature of their speech.

On observing the appearance of the masts, the main-top-gallant-mast-head, from the truck, for three feet down, was perfectly enveloped in a cold blaze of pale phosphorous-looking light, completely embracing the circumference of the mast, and attended with a flitting or creeping motion, as exemplified experimentally, by the application of common phosphorus upon a board; and the fore and mizen top-gallant-mast-heads exhibited a similar appearance in a relative degree.

This curious illumination continued with undiminished intensity for the space of eight or ten minutes, when becoming, gradually, fainter and less extensive, it finally disappeared, after a duration of not less than half an hour.

The seamen, in the meantime, having finished their devotions, and observing the lights to remain stationary, returned promptly to the yards, and, under favour of this " Spirit of the Storm," now quickly performed that duty, which, on a critical conjuncture, had been abandoned, under the influence of their superstition and their fears. During the prevalence of the lights, as well as through the remaining hours of night, the wind continued, except in occasional puffs, light and variable; and the morning ushered in with a clear sky, a hot sun, and a light southerly breeze, which, in due time, brought us safe to the anchorage of Palma.

Conversing with the interpreter on the nature of this extraordinary atmospherical phenomenon, he expressed his implicit belief that it was provided by the immediate power of St. Elmo, the tutelar deity of " those who travel on the vasty deep," in regard to their interests

in a moment of sudden danger; and used every argument to persuade me, that the present safety of the ship was due to the very timeous and friendly interference of this aerial demigod; and that no accident could possibly have happened to the sails, while the seamen were at prayers, as long as the light glowed stationary on the mast. Had the light, he continued, descended gradually from the mast-head to the deck, and from thence to the kelson, as he had often seen it, the event would have prognosticated a gale of wind or other disaster, and, according to the depth of the descent, so would be the nature of the evil to come. In the present instance, the lights gradually disappeared, like the snuff of a candle, and the weather continued clear and fine for several subsequent days.

[*Boston Journal*.

An Account of the Passage of Water through an Aqueduct being totally obstructed by collections of Air; and on the Equilibrium of different fluids in bent tubes. By D. Treadwell.

A lead pipe, having a bore an inch and a half in diameter, was laid from a well in Roxbury, to the mills at the water works on the Boston mill-dam, for the purpose of supplying the workmen, who carry on the various manufactories erected on the mill-dam, and their families, with fresh water. The surface of the water in the well was found, by a survey, to be somewhat higher than any of the ground through which the aqueduct passed. The whole length of the aqueduct was about 6000 feet, and its general course was through a salt marsh; in its way, however, it passed under the bed of two creeks, which may be taken at 12 feet deep, each, and near its termination, it descended from the marsh to the bed of the bay on which the mill-dam is built. It was laid about three feet beneath the surface of the marsh, and opened into a reservoir at the city mills, four feet below the level of the surface of the water in the fountain well.

After completing the aqueduct and opening it into the well, it was found that not a drop of water would run through it. As it was known that there were no mechanical obstructions in the pipe, it was thought not a little anomalous that the water should not pass through it.

In this state of things I was requested, by those interested in the aqueduct, to consider the circumstances, and endeavour to procure a passage of the water. When the exact condition of the aqueduct was taken into consideration, I perceived that the water let into it might have made such an arrangement, in relation to the air with which the pipe was previously filled, as wholly to obstruct its passage. For let us suppose in the annexed figure, A B to represent a pipe open throughout its length, but its sides being perfectly tight, and having the several vertical flexures here represented, and let it be

required to pass water, or any heavy fluid, through it in the direction from A to B, the end A being elevated the distance *a b* above B, *c d* being a horizontal line. It is evident, that the water being let into the end at *a*, will pass and fill the pipe to *e*, displacing all the air with which the pipe, being open to the atmosphere, was previously full. Flowing over the curvature *e*, in a stream or column less than the bore of the pipe, it fills the curvature at *f*, without displacing the air previously contained in the descending section from *e* to *f*. This air is thus shut up, and cannot pass from the pipe in any direction, without passing under the water, which, from its inferior specific gravity, is impossible. The water, continuing to flow over the flexure *e*, rises from *f* to *g*, and flowing over this flexure, the same thing is repeated, as to the air from *g* to *h*, which took place at the flexures *e* and *f*. Rising from *h* until it attains some point, *i* for example, at which the sum of the perpendicular heights of the ascending columns *c e*, *f g*, &c. is equal to the height of the column *a b*. That is, if we suppose the air to be un-elastic and void of weight, but as this is not true in fact, the air will be condensed in a greater or less degree, according to its volume and the height of the columns of water opposed to it. In consequence of this condensation, the water will rise, as shown in the figure, to *k* and *m*, for example, and the weight of these columns being added to the effective force of the column *a b*, produces a rise of the water to some point, *n*, in the flexure *h n*. There is then a perfect equilibrium in the opposing forces, and the water can flow no farther. This equilibrium may be expressed, generally, by

$$ab + cd = be$$

in which *a* is the perpendicular height of the water in all the descending flexures; *b* its density; *c* the perpendicular height of all the enclosed air; *d* its mean density; and *e* the perpendicular height of all the ascending columns of water.

Several writers on Hydrodynamics, have noticed the obstruction which air often presents to the passage of water in bent tubes; but in the works that I have had an opportunity of consulting, the authors appear to regard the air as collecting in the high parts of the tube, and partially closing its bore, thus diminishing, without totally obstructing, the discharge. This is quite different from the effect of the arrangement which I have attempted to explain. Those, however, who are acquainted with this subject, will recollect the Zurich machine for raising water, invented many years since, as owing its efficacy to an arrangement which the air and water take in a spiral tube, very similar to that stated in the preceding part of this paper.

As the aqueduct at the mill-dam was more or less bent through

its whole course, the flexures being considerable at the creeks under which it passed, it appeared to me certain that it was partly filled with air, and that this alone interrupted the flow of water. On opening small holes into it in several places, air rushed out in great quantity; still, however, the water did not flow at the reservoir, and as it was impossible to get at the bendings in every part of the pipe, without the labour of uncovering it wholly, the design of freeing it from air by piercing it with small holes, was suspended. A forcing pump was then coupled to the upper end of the pipe, and water, which had been heated in the worm tube of a distil house, in the vicinity, was forced into it. The pump was furnished with a valve loaded with a weight equal to a column of water 80 feet high, and a very small opening made from the aqueduct into the reservoir at the mills, so that the water passing slowly through the whole length of the aqueduct, was there discharged. The object of this apparatus, was, to produce an absorption of the air, by bringing it in contact, under heavy pressure, with water which had parted with some of its air, by being heated; as these conditions are known to be favourable to the absorption of air by water. The pumping was continued about ten days, and the quantity of water used may be taken at 20 hogsheads; when the pump was taken off, and the aqueduct opened into the fountain. The water was then found to flow at the reservoir, discharging as much as was due to the head. This discharge has continued uninterruptedly to the present time, about five months. There can be no doubt but much air was absorbed, its presence in the aqueduct being indicated, when the pumping was commenced, by its throwing a stream of water out of the pipe, on which the loaded valve was placed, whenever the weight was removed from the valve. The quantity of water thus thrown back was much too great to have been produced from the elasticity of the water, or the lead pipe, and it diminished daily, having almost ceased before the pump was taken off. [*Ib.*

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS GRANTED IN NOVEMBER, 1828.

With Remarks and Exemplifications by the Editor.

1. For a mode of *Applying Steam for Extracting Tannin,* and other ingredients, from the bark, and other substances used in tanning; William Coburn, Gardiner, Maine, November 1.
(See the specification.)

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2. For an improved *Plough, for Ploughing Hill-sides,* denominated the 'Hill-side Plough;' Norman Staples,. Penn's Store, Patrick county, Virginia, November 1.

The object to be attained by the use of this plough, is the turning of the sward down hill, in horizontal ploughing, in both directions.

To accomplish this, there are two shares and mould boards, placed on the opposite sides of the beam; when one of these is in the ground, the other is, of course, turned up into the air. On arriving at the end of a furrow, the plough is inverted; that which was the upper share, being now turned into the ground.

The plough handles turn upon a pin at the end, by which they are affixed to the beam of the plough, so that when the instrument is inverted the handles may be made to assume their proper position. They are secured by a spring, to either end of a piece of timber in the form of a segment of a circle, attached to the end of the beam for that purpose. In the drawing which accompanies the description, each handle is represented as forked, or split at the end, and the divided part bent in opposite directions, so that it may be held conveniently either way. The patentee says, "I claim as my invention the use of one more share than is commonly used, and the spring, the circular pieces of wood in the beam, or, in fact, the particular construction of the whole, in order to turn the sward down hill."

There is in the Patent office a model of a plough, deposited there in January, 1815, by John Brown, which is perfectly similar to the foregoing in all its essential features. It does not appear to have been patented, probably, because there are others of still older date, which are constructed in the same way.

A double plough, intended to answer the purpose of the foregoing, was patented by John Cromwell, of Maryland, in 1816: in this plough there are two mould boards and shares of the ordinary construction, turned back to back, and a moveable beam, to which the horse is attached, turns upon a pin on the centre of the fixed beam which unites them. The horse and moveable beam turn round at the end of every furrow, they being confined together, temporarily, by proper catches; the right and left handed ploughs are thus, alternately, brought into action.

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3. For an improved *Thrashing Machine;* Samuel S. Allen, Skeneatelas, Onondago county, New York, November 1.

A cylinder, with teeth, is made to turn horizontally; beneath this is a fixed concave segment of a cylinder, forming about one-sixth of a circle, which is also set with teeth, which are to separate the grain from the ear.

A feeding apron, moved by rollers, in the usual way, carries the grain forward between the cylinder and the concave segment.

The concave segment is made of separate strips of timber, which are capable of being placed at different distances from each other, by the aid of wedges, screws, or other contrivance. The teeth are not to be inserted vertically, either in the cylinder, or segment; and particular angles of inclination are given, such as the patentee thinks the most advantageous; their distances apart are also designated, and the direction of the lines in which they are to be set.

The specification ends thus: "The above form and size of the

various parts of the machine, are convenient in their construction, but may be varied at the pleasure of the builder; especially where great water power can be easily obtained, a larger machine will, of course, be more useful and expeditious in its operations."

"I claim as an important improvement, the arrangement and inclination of the teeth, in the bed, or curb, of the machine, by which arrangement the grain is readily introduced into the machine, and a great saving of power is thereby effected, the straw is less broken, and the operation of thrashing is performed in a much neater and more cleanly manner. Also in the construction of the bed in separate pieces, with keys and mortises, screws, wedges, or otherwise, whereby each alternate piece may be moved in an opposite direction, and the operator is thereby enabled to increase, or lessen, the space between the teeth in the bed and those on the cylinder, at pleasure, and adapt it to the thrashing of various kinds of grain, according to the quality, or the damp or dry state thereof."

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4. For an improvement in the *Manufacture of Malleable Iron*, and an improved *Bloomery Furnace;* Benjamin B. Howell, Philadelphia, November 6.

(Specification, with a plate, in this number.)

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5. For *Collars for Dress Coats* and outer garments; Henry Clark, Brooklyn, Windham county, Connecticut, November 7.

The specification states that "the aforesaid collars are to be manufactured from wool, fur, and hair, separately, or combined, in the same manner that the said materials are now manufactured into hats; and to be worked on blocks, shaped to any pattern you design for the collar, and stiffened with the kind of stiffening known by the name of 'water proof.'"

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6. For an improved mode of *Drawing and Corking Sparkling Liquors*, with a view to the preservation of their clearness and sparkling quality, (previously acquired,) notwithstanding the drawing and corking of the same; Steen Anderson Bille, New York, November 8.

We were about to make an abstract of the specification of this patent, but have found in it so much of ingenuity, novelty and science, that we have thought its full insertion would be acceptable to our readers, notwithstanding its length. We are aware that many objections may be urged against the plan proposed, and confess, for ourselves, that we should be unwilling to insure the utility of a structure and apparatus like those patented by Mr. Bille. We know, however, that it was the design of this gentleman to have carried his plan into execution, had not an unexpected change in his pursuits called him suddenly to a distant country.

7. For an apparatus for *Saving Heat* in the process of combustion; Steen Anderson Bille, New York, November 8.
(For specification, see p. 401 of the last volume.)

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8. For various new and useful improvements in the mode of *Washing, Filling, and Corking Bottles,* more particularly with a view to system, despatch, and cleanliness, in these operations, as belonging to large bottling establishments; Steen Anderson Bille, New York, November 8.

The specification of this patent occupies twenty-one written pages, and is accompanied by three drawings of the machinery to be used for cleaning, filling, and corking. In the operation of cleaning, the bottles are to be placed upon shelves, in an inverted position, their necks passing through holes made for that purpose. Under the neck of each bottle there is a tube standing vertically, its upper end being perforated, so as to throw out numerous jets of water: the lower ends of these tubes are connected to a common reservoir of water, which may be forced from it under a sufficient head, or by a forcing pump. There is an apparatus for lowering the shelves, so that the tubes may pass into the bottles, and reach nearly to their bottoms. When so situated, the water is let on, and rushes into the bottles, which, during the operation, may be raised and lowered by the motion of the shelves.

In the filling machine the liquor to be bottled is contained in a proper box, or vessel, from each side of which project rows of tubes, bent like a syphon, with their open ends downwards. The bottles to be filled are placed in rows, upon shelves, under the tubes: these shelves are to be raised by proper machinery, so that the syphons may reach nearly to the bottom of each. The bottles are to be of the kind blown in moulds, that they may be all of one height, that when the valve is open, which allows the liquor to flow into them, it may rise in each to the proper height for corking, at the same instant, the syphons causing the liquor to stand, in them, at the same level with that in the box.

The corking machine is intended as an improvement upon that of Masterman, patented in England in 1825, and of which an account is given in this Journal, vol. 3. p. 161. The corks are forced by pistons through conical funnels, under which are placed the bottles. Cylindrical corks are preferred, as they expand in the neck of the bottle, and fit it more perfectly at their lower ends, than others. Three-fourths of the specification are occupied by a description of this machine, which is too complex to be understood without drawings; it is not, we apprehend, of sufficient general interest to justify the assigning to it the space which it would require.

To insert the words of the claim, would be to repeat much of what we have said above; it is therefore considered unnecessary.

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9. For an improvement in the mode of *Cutting of Pins, Rivets, Bolts, Bars,* and other pieces, from wire, rods, and bars, of

iron, steel, and all other metals, without bruising or marring the end cut off, by machinery, at one operation, called an improved cutting machine; Abiel Stevens, Essex county, Massachusetts, November 11.

The machinery consists of two steel plates, one of which forms a bed, and the other is made to revolve, or slide upon it. These plates are to be accurately fitted, and well hardened; they are to be perforated so that the wire, or bar, to be cut, may pass through both plates, the holes nearly fitting the wire, or bar; by causing one plate to revolve, or slide, upon the other, by means of a lever, or other power, the operation of cutting will be performed.

The principle upon which the above machine operates, is precisely similar to that of the shears or cutters used in cutting off bars of iron in rolling and slitting mills. We do not recollect any instrument exactly in the form described by the patentee, and we think that for cutting round wires, &c., cutters with right angled edges, working like common shears, with semicircular grooves in each cutter, corresponding with the size of the bar, rivet, or wire to be cut, would be more convenient than perforated plates.

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10. For machinery for making *Window-sash, Window-blinds,* Doors, Fence, all kinds of cabinet-work, Looking-glass frames, and all kinds of small carpenters-work; Jedediah Richards, jr., Elbridge, Onondago county, New York, November 12.

This is a machine to saw, plane, and mortise stuff for sash, and other purposes. The description is too obscure and incoherent to convey a correct idea of it, whilst it appears to resemble, in many particulars, other machines which have been heretofore made for similar purposes. The patentee has not informed us what he claims as new, and we are consequently left to infer that he considers the whole as such.

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11. For *Bleaching, or Whitening Leghorn, Straw, and Gimp,* without having recourse to sulphur, or sulphuric acid, &c.; Henrietta Cooper, Washington, Franklin county, Pennsylvania, November 12.

This being a recipe, we omit its publication.

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12. For a machine called the '*Spiral Curvilinear Compressor,*' for expressing water, suds, dye, or other liquid matter, out of wool, cotton, hemp, or any fabric or article formed thereof, by compression between cords, ropes, or chains, operating in spiral curve lines; William Nelson, Batavia, Gennessee county, New York, November 13.

This is, in fact, a *Wringing Machine;* it consists of two standards of stout timber, connected to each other by any proper framing, and standing three feet, more or less, apart. Into one of these standards a circular piece of wood, which is called a head block, is firmly

fixed; a similar piece revolves, opposite to it, in the other standard. These head blocks are perforated with holes, through which a rope is passed, going alternately from one block to the other. The several lengths of rope are then formed into a sort of net work, by strong cord, interwoven crosswise, thus forming a kind of sack, or net, into which the articles to be wrung are placed. By turning the moveable head block, by means of a crank, or lever, the ropes are twisted upon the contained articles, which are thus strongly compressed, and may be wrung nearly dry.

Machines very similar to this have been long known. A Mr. Beetham obtained a patent for one in England, about forty years ago. Their fate, however, appears to have been similar to that of their relatives, the numerous family of the *washing machines*, most, if not all, of which have retired to lodgings in the cellar or the garret, and left the soap-suds in the undisputed possession of the old fashioned washing tub. It is only in manufactories, or large public establishments, that they have continued in use.

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13. For a mode of working, or manufacturing *Slates, and Slate-pencils*, by machinery, called Symington's machinery; Thomas Symington, Baltimore, Maryland, November 17.

We cannot attempt to describe the whole of the machinery referred to in this specification, as it includes not only the grinding, smoothing, and squaring of the slates, but the mortising, tenoning, grooving, and performing other operations on the frame.

The specification is of great length, the whole of the machinery, and its operation, being described with great minuteness; but no particular claim is made to any part; of course, the whole arrangement of the apparatus, as applied to this particular object, is considered as new, by the patentee.

The main machine for grinding, consists of a bed formed of cast iron plates, forming a ring of thirty feet in diameter, and one foot in width. These plates are supported by a wall of masonry, or other stable foundation. A vertical shaft, with four, or more, horizontal arms, projecting from it, carry lateral arms upon their ends, beneath which is the apparatus for holding the slates to be ground. From the end of each arm, sand is made continually to drop upon the cast iron bed, and when the slates have been sufficiently ground, they are transferred to the smoothing machine, the bed of which is of fine grit, where their surfaces are finished.

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14. For an improvement in the *Plough*, called the bar-share plough; John Deakyne, Petersburg, Virginia, November 18.

The specification of this improvement is very brief; we therefore insert the whole of it, which is in the following words.

"The improvement in the bar-share plough, is as follows, to wit: The iron rod which confines the share and beam together, is placed immediately behind the front edge of the mould board, which is of

cast iron, and directly in front of the stand post. The benefit of this improved position is, that it leaves the edge of the mould board to form a complete cutter, by itself, without any obstruction; and it thereby renders the plough less liable to be choked, or impeded by grass and weeds; it also dispenses with the use of a wrought iron cutter placed on the point of the share, and running up through the beam."

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15. For an improvement on the '*Machinery for Moulding and Pressing Bricks at one Operation,*' for which a patent was granted to James M'Donald, of the city of New York, on the 24th day of April, 1827; James M'Donald, and Robert M'Queen, jr., New York, November 19.

The original patent, granted in 1827, was for machinery to manufacture bricks direct from the clay, without going through the usual process of mixing it into mortar. It is merely to be divided into pieces sufficiently small to pass through a screen with wires half an inch apart. This is effected by a machine called the *Granulator*, which contains knives or cutters, worked by the power which drives the principal machine.

A moulding and pressing wheel of cast iron, is fixed on a strong vertical shaft; upon its circumference or rim, are twelve or more cavities of a proper size and form to mould a brick. Into each of these work moulding and pressing slides, by which the brick is consolidated, after which it is made to advance over, and fall through, an opening, and is received upon an endless band, by which it is carried to the place of delivery.

The clay is contained in a hopper, from which it passes by its own gravity into the moulds.

We do not attempt to describe the slides, pistons, cams, friction rollers, &c. which are used in, and necessary to the operation, as without a plate, or plates, they would scarcely be understood.

The present patent, whilst it preserves the main features of the machine, makes a number of alterations in its details, as in the situation of its hopper, the manner of feeding the moulds, of delivering the bricks, &c., which, for the reason above stated, must be dismissed with this passing notice.

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16. For *Knot Shuttles,* and machinery by which they are operated, for the purpose of tying knots to be applied to the making of weavers' harnesses, seines, nets, netting, fringes, &c.; John Thorp, Providence, Rhode Island, November 20.

It was intended to give the specification of this invention entire, with an engraving from the well executed drawing which accompanies it, but the inventor mentions, in a letter recently received from him, that he has found several alterations necessary, which will vary it so materially as to require a new patent. When this is completed, we will fulfil our first design.

17. For an improvement in *Spinning and Twisting,* consisting of a whorling or rotary ring, and revolving hook, (which are intended to answer the purpose of the common flyer,) and the connexion of the bobbin and spindle; John Thorp, Providence, Rhode Island, November 20.

This we will hereafter publish, with a drawing.

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18. For an improvement in the *Spinning of Filling and Slack Twisted Yarn;* John Thorp, Providence, Rhode Island, November 20.

This will accompany the foregoing.

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19. For an improved *Rail-way Carriage;* Wm. Howard, Esq., U. S. Civil Engineer, Baltimore, Maryland, November 22.

For specification, with plates, see p. 66.

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20. For an improvement in the construction of *Steam Boilers of Steam Engines;* Anthony Hermange, Baltimore, Maryland, November 26.

The specification, with engravings, will appear in the next number.

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21. For certain improvements in the machinery for *Propelling Ships and other Vessels;* Anthony Hermange, of the city of Baltimore, Maryland, and Paul Steenstrup, of Konigsberg, in the kingdom of Norway. Issued in conformity with a special act of congress, passed for that purpose. November 26.

Several modes have been devised, both in this country and in Europe, to cause the paddles of the wheels by which steam boats are propelled, to revolve upon their axes, so that they may enter, and leave the water, with their planes vertical to its surface, and a number of patents have been obtained for different modes of effecting this object. The present patentees propose sometimes to work paddle-wheels entirely under the water line, and apprehend that they shall be able to propel vessels as rapidly, if not more so, than in the ordinary mode; whilst in ships or boats where they are so placed, there will be but little sensible agitation of the water, which will add to the comfort of those on board, and render the machinery more durable, whilst the wheels will be protected from cannon shot.

When the paddles are all placed under the water, they are made so to revolve upon their axes, that at the upper part of the wheel to which they are attached, their planes are horizontal, or at right angles with those at the lower part.

The drawings which accompany this patent are large, and, though complex, perfectly descriptive. We are of opinion, however, that in practice no advantage will be derived from causing the paddles to revolve on their axes, but that more will be lost by every mode of

producing this result, than will be gained by their acting vertically upon the water. If, however, it be desired to immerse the wheel completely, the modes proposed will render this practicable, and under these circumstances might be adopted with advantage. Should the patentees test their plans by carrying them into effect upon a large scale, which they intend to do, and the result should be favourable, we shall with pleasure not only make the fact known, but have all the engravings executed which may be necessary to the description of the invention.

The specification, and the explanation of the drawings, occupy upwards of twenty very closely written pages.

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22. For improvements in the machinery for *Propelling Ships and other Vessels;* Anthony Hermange, Baltimore, November 26.

A patent under the same title was obtained by this gentleman on the 31st of May, 1828, and the present is in continuation of that patent, being for certain modifications of the principle upon which that was founded. It may also be considered as connected with that granted to him and Mr. Steenstrup.

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23. For an improvement in the *Boot-tree;* Joshua Ayars, Brookfield, Madison county, New York, November 27.

The object proposed, is, to stretch or raise a boot at the instep, and to swell the lower part of the leg, which is done by turning a screw passing through the boot-tree, which, acting upon pieces of iron, produces that effect.

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24. For *Improving the Shape, Carriage, Action, and Powers of Horses,* by a new method of feeding them; Aaron Carman, Hyde Park, Dutchess county, New York, November 27.

"The peculiarity of his method is, to feed horses and colts by placing the food, whether it be hay or grain, as high above their heads as can be done, allowing the animal to eat with ease to himself."

The method of feeding on the ground, or from box mangers very little elevated, generally not higher than the breast of the horse, is considered as injurious, as colts, from the period of weaning, are, during the time they are eating, which is supposed to be three-fourths of their whole time, kept with their heads and tails down, and their feet in a position unfavourable to shape and action. The evils which are supposed to result from this practice, are stated at length by the patentee.

The improvements claimed, are, first, the elevation of the manger, so that "the horse can barely get his head over the perpendicular side of it, next to him, so as to reach his food, lying in the bottom of the manger." As this height should be adapted to that of the horse, the manger is made to slide up and down between posts.

Every mode of effecting the same object is claimed as appertaining to the principle upon which the improvement is founded.

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25. For a mode of manufacturing *Pressed Brick and Tile*, at one operation, by a machine called 'Parker's Brick Press;" James Parker, M. D., Gardiner, Kennebeck county, Maine, November 27.

A strong wooden bench is placed horizontally; at one end of this is a brick mould, made of iron, cast in one or more pieces. A piston slides into this mould, having a rack at the back of it, into which a pinion works, which is moved by a lever. There is also another lever, or treadle, below the bench, upon which the foot is to be placed, by which a powerful pressure is made upon the end of the rack, in aid of that given by the hand, which moves the lever and pinion. A second lever under the bench, to which the foot is shifted after the brick is pressed, raises it from the mould and delivers it upon a board, when another is placed in the situation to be pressed.

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26. For an improvement in the *Wicket or Paddle Gate* and its fixtures, for the locks of canals; John F. King, Waterford, Saratoga county, New York, November 29.

The general construction of this gate is the same as usual, the novelty claimed is in the following words:

"What I claim as my improvement in the above described gate and fixtures, is the gate, together with the gudgeons, or pivots on which it turns, being made of one entire piece of cast metal, instead of those heretofore used, made of wrought iron, or this and cast iron together, or of wood and iron. I likewise claim the manner of securing the top gudgeon by means of a slide, instead of a clasp or hasp and bolts, or staples, as heretofore used."

The manner of securing the upper gudgeon above referred to, is, by one half of the box, or bearing, within which it works, sliding upwards in a dovetail, or groove, so that it may be removed and replaced under water.

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27. For a machine for *Proving Hemp and Chain Cables;* John Judge, Washington city, D. C., November 29.

The power is obtained, as in some similar machines, by compound levers with long and short arms. What is claimed as new, is the making the bearings, or fulcrums, of all the levers in the form of those of a scale beam, usually called the knife edge suspension, the whole being made true and hard, the friction is consequently reduced to a mere trifle.

Specifications of American Patents.

Specification of a patent for a mode of applying Steam for Extracting Tannin and other ingredients, from the bark, and other substances used in tanning. Granted to William Coburn, *Gardiner, Maine, November* 1, 1828.

"This improvement consists in applying *steam* to the substance from which tannin is to be obtained, in the following manner. The steam is conveyed from the boiler by a tube, into the lower part of a *cistern*, or *tub*. The tub, or vessel, used for the purpose, is furnished with a false bottom, perforated with holes, and raised a few inches from the true bottom. The tub is filled with the substance to be acted upon by the steam, which is suffered to pass into the tub between the two bottoms. Cold water, or bark liquor, is then, occasionally, poured into the top of the tub, and the liquor thus obtained is drawn off by means of a cock placed between the bottoms of the tub. The advantages of this mode, are, 1st, the simplicity of the apparatus necessary for the application of the steam; no pressure is required to confine the steam in the tub, other than the weight of the materials acted upon. 2nd. By the application of cold bark water, or liquor, or cold water, the steam is found to penetrate the substance much more easily, and a greater quantity of tannin is obtained. This form of apparatus, and the method, is very useful and convenient for extracting glue from the substances which contain it; also for lixiviating wood, or other ashes, either for *potash*, or *soda;* for the colouring ingredients of dye stuffs, the active principles of medicines, &c. William Coburn.

Remarks by the Editor.—We are at a loss to perceive any advantage to be derived from the separate boiler, from which the steam must be conducted through a tube, down between the two bottoms. Why would not the boiler itself answer all the purposes required? There might be a false bottom, or grating, upon which the bark or other materials might rest, with the fire under the true bottom; there would, in this way, be less loss of heat, and more steam generated and applied to use, than by the plan proposed. "Wood, or other ashes," would soon find their way between the two bottoms; and even if they did not, the solubility of the alkalies is such as not to need the aid of steam; and if they did, the steam, applied in this way, is no more than boiling water.

Steam has been repeatedly applied to the heating of water in vats and coppers, by carrying tubes to the lower parts of these vessels. The principal advantages proposed have been, the obviating the risk of injuring the contained materials by the direct action of the fire, the preservation of the vessels themselves, and the heating of several by attending to a single fire.

Specification of an improvement in the mode of drawing and corking Sparkling Liquors, with a view to the preservation of their clearness and sparkling quality (previously acquired,) notwithstanding the drawing and corking of the same. Issued to Steen Anderson Bille, *New York, November* 8, 1828.

This invention consists in performing the operation of drawing any sparkling liquor, as malt-liquor, or cider, from one or more vessels, and filling one or more other vessels with it, as also of closing it firmly in such one or more other vessels, by corks, plugs, or stoppers of any kind, the whole under an artificial *pressure*, by means of compressed air, corresponding with, or in some measure exceeding, the sparkling power of the liquor in question; thereby preserving unimpaired, such sparkling power of the liquor, as well as its clearness, (both being the result of repose and pressure,) notwithstanding the drawing and corking of the same.

To effect this, an air chamber is constructed, sufficiently strong to retain the air, compressed to any degree required, and sufficiently spacious to allow the whole operation above stated, to be performed within its walls.

It having been fully ascertained, by the use of diving bells, that the lungs of man are not effected, in any manner injurious to health, by breathing air, for a limited time, under an artificial pressure of one or two atmospheres in addition to the common atmospheric pressure, there can, of course, be no reasonable objection to one or more persons, as the work may require, closing themselves up in an air chamber of the above description, similar in its operation on the human frame, to a diving bell, descending in the water to a depth producing a similar compression of the air within. The air in both vessels, viz. in the diving bell and in the air chamber for the drawing and corking of sparkling liquors, is maintained in its purity for animal breathing, by the application of an air-pump; and while the pressure in the diving bell is produced by, or depending upon, the depth to which the bell shall be sunk, the pressure in the air chamber for the drawing and corking of sparkling liquors will be produced by the air-pump, and will be depending upon a relieving valve, not admitting the pressure within to exceed the weight by which the valve shall have been previously regulated, with a view to the contemplated operation; or if a column of water be substituted for a valve, then the weight of such a column of water, which latter medium possesses the additional advantage of counteracting any little variation which change of temperature may occasion in the expansion of the air within, by either receding from, or filling up, the space of any vessel into which the end of the tube shall be immersed.

If the fermented liquor to be operated upon, be placed in an air chamber of this description, in *open vessels*, it is evident that the development of carbonic acid, or rather the escape of it in the shape of gas, will, by the pressure of the compressed air, contained in the

air chamber, be as effectually checked, to the extent of such pressure, as if the liquor were kept within corked bottles. On the contrary, as far as the chemical energy of the fermented liquor in forming carbonic acid, and emitting it in the shape of gas, exceeds the pressure of the compressed air intended for its suppression, the fixed air will naturally escape; this, however, is so far from being a disadvantage, that it actually is a most desirable circumstance, affording the means of relieving the liquor from any excess of expansive force, which, otherwise, might endanger the vessels intended for its keeping. Thus the sparkling power of the liquor may be governed and controlled at pleasure, as well with a view to its safety in keeping, as its fitness for a beverage.

When the liquor shall have been kept a sufficient time under pressure in the air chamber, to have acquired the sparkling quality desired, either by fermentation or by some other chemical process, it may be drawn off into bottles, and corked perfectly clear (leaving the sediment in the vat,) and perfectly sparkling, ready for immediate use, as though it had been kept all the while within bottles; provided such drawing and corking of the liquor be performed in the air chamber, that is to say, under the pressure to which the liquor till then shall have been subject. The best proof of this fact is, the flat appearance of any sparkling liquor while under pressure in the bottle, notwithstanding the motion given to the liquor by turning or upsetting the bottle in which it is contained. It may, therefore, in a similar manner, be handled without any loss whatever of its acquired qualities, in pouring it from one vessel into another, provided only as above stated, the pressure be preserved during the operation.

The fermented liquor to be operated upon, is introduced into the air chamber by means of a cylinder, without the air chamber, placed horizontally, or nearly so, above the height of the vats within, intended for the reception of the liquor. This cylinder is furnished with four tubes and cocks, two communicating with the air chamber, viz. one on the top of the cylinder, communicating with the air in the air chamber, the other at the bottom of the cylinder, communicating with the spout leading to the vat within, intended for the reception of the liquor; and two communicating with the atmosphere, the one at top with the air, the other at bottom with the liquor to be introduced; thus, by alternately shutting and opening the respective cocks, the liquor may successively be supplied to the cylinder, and emptied into the vats in the air chamber.

For the admission of the person to perform the operations of drawing and corking the liquor, a manhole is formed in the top of the air chamber, having a lid inside, which closes hermetically, by the pressure of the air within. A moveable cylinder, closed at top, covers the person who is to enter; this cylinder is screwed air-tight to the rim or flanch of the manhole. On opening a communication between the air chamber and the cylinder by means of a cock, the state of the air in both will be equalized, and the entrance through the manhole thereby rendered perfectly free. On leaving the chamber the same way, the manhole is shut, and a communication opened

between the cylinder and the atmospheric air, which will relieve the cylinder from the compressed air within, and thus allow the cylinder to be removed to let out the person shut up in it.

The bottles are introduced into the air chamber, and again delivered out from the air chamber, through one or more boxes attached to the chamber, having a door at each end; the one opening into the air chamber, and the other communicating with the atmosphere. The bottles are placed upon a moveable shelf, and thus introduced into the box; closing the door and opening the cock of a tube connected with the box and the air chamber, the air in both will be equalized, and thus the entrance into the air chamber rendered free. By reversing the operation, the shelf with its bottles may, in a similar manner, be let out. If two boxes be made use of, some saving may be made in the expenditure of compressed air at this operation, by equalizing the air in both the boxes, the one for letting in, the other for letting out, before any new communication is opened, either with the air chamber or the atmosphere, as the case may be.

The application of four boxes will be still better, with a view to despatch in receiving, filling, corking, and again delivering out the bottles, agreeably to a new plan, invented by the undersigned for performing these operations. If the liquor is to be drawn off in vessels larger than bottles, as barrels or casks, such vessels, being necessarily perfectly tight and strong, are placed near the air chamber, from which two pipes are made to communicate with the top of the vessel, by two corresponding holes and sockets, or flanches, in the vessel; the one for equalizing the air in both, the other for drawing the liquor from the vats in the air chamber: thus, by turning the respective cocks, the above operation may be performed at pleasure.

To prevent any mustiness forming on the top of the liquor in the vats in the air chamber, in consideration of a more extended surface of the liquor being in contact with the air in this way, than when closed up in bottles, but still more so with a view to the air in the air chamber being constantly renewed for the sake of respiration, the surface of the liquor ought to be covered with a floating lid, or top piece, having only a trifling space open round its edge to prevent it from sticking to the vat, and this little space may still further be closed up by some liquid, lighter than the liquor in the vat, as water, spirit, or sweet oil, not easily affected by the air, nor affecting itself the liquor.

With a view to the safety of the person entering the air chamber, a pliable tube may be attached to the opening inside, through which the air is forced into the air chamber by the air-pump, necessarily at work when any person is engaged in the chamber, which tube, when taken up by such a person, or placed near to him only, will infallibly secure to him a current of air, abundantly sufficient for respiration; besides which, the whole air in the chamber may, occasionally, be renewed for the same purpose as above stated, and even before entering the chamber, the actual state of the air may be fully ascertained by cocks, communicating with the interior, and, if required, a general purification then be effected by the air-pump. If

an additional air-pump be applied for the emission of air from the lower part of the chamber, the carbonic acid gas being the heaviest, while, by the other pump, air is forced into the upper part at the same ratio; the connexion of both with a common fly wheel, will counterbalance the power required for the latter operation, leaving only the friction to be overcome, which will facilitate the purification of the air within to such a degree as to admit of keeping it constantly as pure as the air without, whatever the size of the chamber may be, by the mere overcoming the friction of the air-pumps thus applied. Light is best admitted by reflection from without, to avoid any inconvenience from the direct application of lamps within.

To shorten the time necessary for any person to stay in the air chamber, it is desirable that such improvements in the drawing and corking of liquors should be adopted, as will facilitate this operation; such improvements, however, forming no part of the present invention, it is unnecessary here to enlarge upon the subject any further.

With regard to the construction of the air chamber, strength and tightness constitute the qualities indispensably required; these may be obtained in different ways, but it is presumed to be the cheapest plan to give to the air chamber a circular shape, by which the two sides are made to form, as it were, one cylinder within another, kept together by square frames of beams, placed vertically at suitable distances, radiating as it were from a common centre, and enclosing at the same time both top and bottom, while the whole is lined with planks, forming an entire box, to be covered internally, with some substance fit to render the chamber air-tight, as zinc, or lead in sheets. If the width, or height, be too great for the frames to sustain the pressure from within, bars of iron may be applied in support of the middle of the beams; by thus connecting the cross beams of the opposite sides, as well as those of the top and bottom, which will not materially interfere with the application of the space within, to the purposes intended.

When the air chamber shall be duly protected against the variations of the temperature of the external air, the temperature of the air within may be kept pretty uniform, or at any degree required, by suffering the air, in entering the chamber, to pass through a cooling, or a heating vessel, as the case may require.

Although several advantages, as above stated, will result from the application of an air chamber, in keeping quantities of liquor under pressure for the purpose of rendering them clear and sparkling, the subscriber does not claim such advantages, generally, as his invention; but he confines himself, in his claim of invention, to the mere drawing and corking of sparkling liquors *under pressure*, by means of an air chamber, containing air compressed to any degree required, whereby the clearness and sparkling quality of the liquor, previously acquired, either in the air chamber or elsewhere, will be preserved unimpaired, notwithstanding the drawing and corking of the same.

STEEN A. BILLE.

The Patent Thomsonian Practice of Physic.

The above dignified title is used to designate the administration of certain vegetable preparations, and the employment of the steam bath, in the cure of a number of disorders. To these medicines, and the mode of administering them, an exclusive privilege is claimed, under a patent from the United States. Several instances have been narrated in the public papers, of the fatal effects of this practice, whilst those interested in its favour, assert that these accounts have been falsely represented by the medical faculty, who, they aver, have risen in arms against it, because it is destroying their practice. The support of a number of intelligent and disinterested persons, has given currency to the claims of these Thomsonian practitioners; and, under this sanction, their business has become very extensive, particularly in some of the western states. Without intending to express an opinion upon the subject, we will observe that it is the fate of every popular medicine, to obtain the kind of support which the practice in question has received. Such preparations are usually active, and, when properly administered, they are beneficial; their indiscriminate employment, therefore, will insure their occasional usefulness. Whenever they are successful, the cured, and their friends, naturally enough, praise the medicine; whilst the patient, the disease, or the physician, bears the blame, when their effects are injurious.

Numerous applications have been recently made for copies of Mr. Thomson's specifications, as questions have arisen which will call the merits of the practice, and of the practitioners, before a court and jury. Under these circumstances, we think that the publication of both the patents which have been obtained by Mr. Thomson, may subserve the cause of science, and of humanity. The first patent expired on the 2d of March, 1827, the second having been issued upwards of four years before the termination of the period of the first. In some parts they appear to be identical, as in No. 2, in both specifications, and in other parts also. Under these circumstances, the question may arise, whether the claim under the second patent is not, in fact, an attempt to prolong the first, as it does not specify the particular improvements claimed, but appears, broadly, to include the whole practice recommended.

Specification of a patent granted for "Fever Medicine." To Samuel Thomson, *of Surrey, county of Cheshire, New Hampshire, March* 2, 1813.

A specification for preparing and using certain medicines in fevers, colics, dysenteries, and rheumatisms.

No. 1. The emetic herb, or Lowbela (Lobelia?) medica, a plant that grows about twelve or fifteen inches high, with leaves of the size of mint leaves, bearing a pod the size of a white bean, of a

sharp taste, like that of tobacco, creating nausea. It must be gathered when the leaves and pods are a little yellow; dried, pounded fine, and sifted, when it forms a powerful emetic. Dose, in powder, from 4 to 12 grains, with or without an equal quantity of No. 2.

No. 2. Cayenne, or red pepper, pulverized.

No. 3. Marsh rosemary, two parts, the bark of bayberry, or candleberry (the myrtle from which wax is obtained from the berry) roots, one part, pulverized, or sumach bark, leaves, or berries, or raspberry leaves, may be substituted. A tea made with one ounce of the above powder (No. 3,) in a pint of boiling water. Dose, a wine-glassful, occasionally, sweetened.

No. 4. Bitters for correcting the bile; take the bitter herb, or *balmony*, barberry bark, and poplar bark, equal parts, pulverized. One ounce to half a pound of wine, or spirit, and hot water. Dose, half a wine-glassful, and for hot bitters, add half a drachm to the ounce.

No. 5 A sirop. Take one ounce of peach kernels, or cherry stones; half an ounce of gum myrrh, made fine; add three half pints of hot water, two ounces of white sugar, half a pint of brandy. Half a wine-glassful to be used three times a day.

Rheumatic drops. Take one gallon high wines, one pound gum myrrh, put into a stone jug, and boil it in a kettle of water for half an hour; when settled, pour it off; add four ounces camphor, half an ounce of cayenne pepper in powder, one quart of spirits of turpentine, then bottle it, and it is prepared for bathing in rheumatisms, any swellings, or external pains.

No. 1, is used to cleanse the stomach, overpower the cold, and promote a free perspiration. No. 2, to raise the inward heat. No. 3, to scour the stomach, promote perspiration, and repel the cold. No. 4, to correct the bile, and quicken the appetite. No. 5, to strengthen the stomach, and restore the digestive powers, after cases of dysentery, or other weakening disorders. The three first numbers may be used in any other case, to promote perspiration, or as an emetic.

SAMUEL THOMSON.

Specification of a patent granted for a mode of preparing, mixing, compounding, administering, and using, the medicine therein described, to SAMUEL THOMSON, *of Boston, Suffolk county, Massachusetts, January* 28, 1823.

First. The mode of preparing and compounding medicine for an emetic, to be administered in diseases caused by cold and obstructed perspiration, such as fevers, colic, rheumatism, dysentery, asthma, numb-palsy, dropsy, and consumption, and various others.

Take the emetic herb *Lobelia Inflata* of Linnæus, dry the pods and leaves, or the leaves only, and reduce them to a fine powder in a mortar; sift and keep it from the air. For a dose, take from ten to twenty grains, steeped in warm water, sweetened. This emetic is called by the patentee, *number one*, in his system of practice in medicine.

The emetic herb, or *Lobelia*, above-mentioned, is a biennial plant, grows about twelve or fifteen inches high, with leaves of the size of mint leaves, and pods about the size of a white bean, containing very small seeds; is of a sharp taste, like tobacco, exciting the glands of the throat, and producing nausea. It should be gathered when the leaves and pods are turned a little yellow, but is good in any stage of its growth: when perfectly dry, the seeds should be shaken from the pods, and preserved separate.

Another mode of preparing the emetic, *number one*, from this herb, is as follows, to wit: take the green herb, pound it in a mortar, and put it in an equal quantity of spirit; after being well steeped, strain off the liquor, and keep it, close stopped, in a bottle for use. Prepared in this manner, and adding *cayenne*, as hereinafter mentioned in *number two*, two drachms to a pint of the liquor. Dose, one tea-spoonful. This is an effectual remedy in removing the effects caused by poison, either taken internally, or by bathing the part affected. The seeds of this plant are more powerful than the leaves, and one half the quantity pounded fine, and steeped as above described, is of sufficient power for an emetic.

Secondly. To retain the internal vital heat of the system, and cause a free perspiration. Take cayenne, (*capsicum*) or red pepper, ground fine; dose, from ten to twenty grains, in hot water, sweetened, or to be combined with the other medicine hereinafter described. This is called by the patentee, *number two*.

Thirdly. To scour the stomach and bowels, and remove the canker. Take bayberry, or candle berry, (*myrica cerifera L.*) (the myrtle from which wax is obtained from the berries) the bark of the root dried and pulverized; the inner bark of the hemlock tree (*pinus canadensis, L.*) pulverized, equal parts of each, steep one ounce of the powder in a pint of boiling water, and give, for a dose, a common wine-glassful, sweetened.

When the above cannot be had, take, as a substitute, red sumach bark, leaves, or berries, (*rhus glabrum, L.*) red raspberries (*rubus streorsus of Michaux*) or witch hazel leaves (*hamamelis virginica, L.*) marsh rosemary, (*statice lemonium, L.*) and white pond lily roots (*nymphœa odarata Ait*) or either of them: let them be dried, pounded, and steeped, as above mentioned. This is called by the patentee, *number three*.

When the violence of the disease requires a course of medicine, take an ounce of the foregoing medicine, *number three*, steeped in a pint of hot water, strain off a wine-glassful when hot, and add ten or twenty grains of *number two*, and one tea-spoonful of sugar; when cool enough to be taken, add from ten to twenty grains of *number one*, and an equal quantity of *nerve powder*, hereafter described, to quiet the nerves. Let this compound be administered three times, at intervals of fifteen minutes, and let the same compound be given by injection once, and, if the case requires it, again repeated.

When mortification is apprehended, a tea-spoonful of medicine, *number six*, as hereinafter described, may be added to each dose, and, also, to the injection. After the patient has recovered suffi-

ciently from these applications, which is usually within two or three hours, let the mode of raising perspiration by steam, as hereinafter described, be applied.

Fourthly. To make bitters for correcting the bile.

Take the bitter herb, (*balmony*) Barberry bark (*Barberis vulgaris, L.*) and poplar bark, (*populus trepida*) in equal parts, pulverized. One ounce to a pint of hot water, and half a pint of spirit. For a dose, take half a wine-glassful; for hot bitters, add a tea-spoonful of *number two:* this is called, by the patentee, *number four.*

Fifthly. To make a sirop for dysentery, to promote digestion, and strengthen weak patients.

Take poplar bark, the bark of the root of the bayberry, each one pound, boil them in two gallons of water, strain it off, and add seven pounds of good sugar, then scald and skim it, and add half a pound of peach meats, or cherry stone meats, pounded fine; when cool, add a gallon of good brandy. Bottle it up, and keep it for use. Take half a wine-glassful, two or three times a day. This is called by the patentee, *number five.*

Sixthly. To make rheumatic drops, to be used to remove pain, and to prevent mortification, given inwardly, or to be added to the injections, or to be applied externally.

Take one gallon of any kind of high wines, one pound of gum myrrh, one ounce of cayenne, *number two*, put into a stone jug, the jug being unstopped; boil it a few minutes in a kettle of water; when settled, bottle it up for use. Or it may be prepared without boiling, by letting it stand for five or six days, shaking it well every day, when it will be fit for use.

For bathing, in rheumatism, itch, or other humours, or in angry swelling or external pain, add one-quarter pint of spirits of turpentine. One or two tea-spoonsful of these drops, without the spirits of turpentine, may be given alone, and, also, may be used to bathe with; or, one tea spoonful may be added to a dose of either of the medicines before mentioned. This is called by the patentee, *number six.*

In the earlier stages, and in less violent attacks of disease, a composition or vegetable powder may be administered, prepared as follows, to wit; take two pounds of the bark of the root of bayberry, one pound of the inner bark of the *hemlock tree*, one pound of ginger, two ounces of cayenne, *number two*, two ounces of cloves, all pounded fine, sifted through a fine sieve, and well mixed together. For a dose, take one tea-spoonful of this powder with a tea-spoonful of sugar, in a wine-glassful of boiling water, as soon as sufficiently cool, the patient being in bed, or covered with a blanket by the fire.

The medicine, *number one*, and, also, the nerve powder, hereinafter described, may be used with this compound, and will be proper in more violent cases.

In all cases of symptoms of nervous affection, a nerve powder must be used, which is prepared as follows, to wit. Take ladies slipper, (*cypripedium pubescens,*) dig the roots when done growing, wash them clean, dry and reduce them to a fine powder. For a

dose, take half a tea-spoonful in hot water, sweetened, or the same quantity may be given mixed with either of the other medicines, in all nervous cases.

When the above described medicine, or such part thereof as may be deemed proper to administer, shall have produced the intended effect, a copious perspiration should be produced by applying heat to the body, by the aid of steam, in the following manner, to wit. Let several stones of different sizes be made hot, then put one (the smallest first) into a pan, or kettle, of hot water about half immersed; place the patient over it undressed, covered with a blanket to shield him from the cold air; change the stones as often as they grow cool, and keep the patient in this situation as long as he can conveniently bear it; then he may be rubbed all over with a cloth wet with spirits, or cold water, and either dress or go to bed.

When the patient is too weak to sit, or stand, over the steam, take three hot stones, quench them a little in water, and wrap them in several thicknesses of cloths well wet with water, place one at his feet, and one on each side as he lies in bed, which will produce a lively steam, and with a dose of medicine, *number two*, taken inwardly, will cause a free perspiration.

The preparing and compounding the foregoing vegetable medicines, in the manner herein described, and the administering them, to cure diseases, as herein mentioned, together with the use of steam to produce perspiration, the said Samuel Thomson claims as his own invention.

SAMUEL THOMSON.

Specification of a patent for the construction of a Furnace for Generating Steam by Anthracite Coal, and for the use of various Manufactures requiring intense heat. Granted to BENJAMIN B. HOWELL, *Philadelphia, October* 14, 1828.

THE improvement claimed, consists in the form and principle of the interior of the furnace, and in its being a separate structure from the boiler or other body to be heated, by the means of which the heat is generated without bringing the fuel in contact with the boiler or other body; and in the application of an artificial blast upon anthracite coal, increasing, in a great degree, the intensity of the heat, and giving it the necessary direction through the communicating flues of the furnace, upon the bodies to be heated.

The drawings exhibit a front elevation, a ground plan, and a section; all upon a scale of six feet to an inch.

The exterior shape and proportions may be varied at pleasure, provided the principle of generating and applying the heat, be retained.

With a furnace of this construction, and a moderate blast, the flame and the heat may be carried to almost any required extent under the boiler of a steam engine or other body, using anthracite

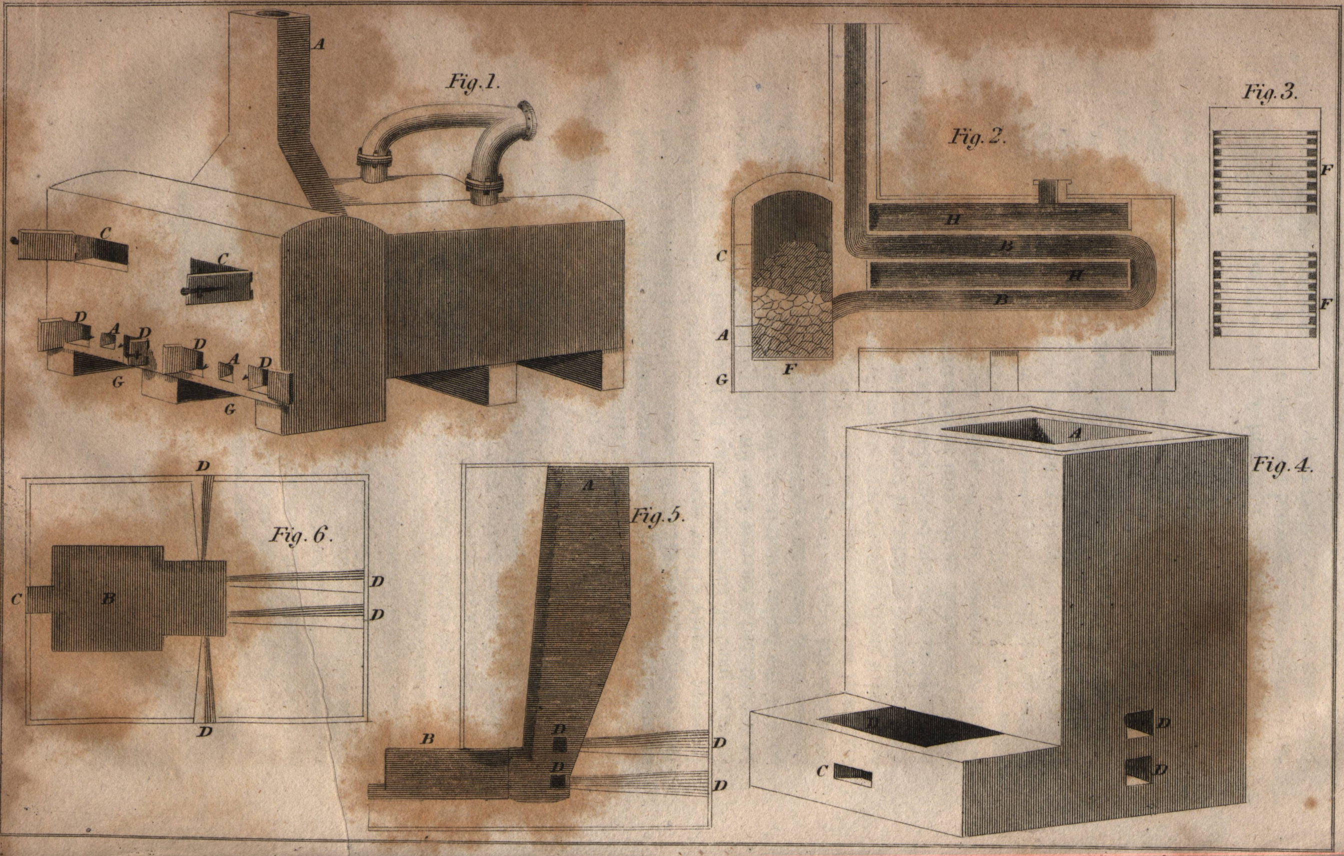

Fig. 1.
A
C
C
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Fig. 2.
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H
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Fig. 3.
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Fig. 4.
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Fig. 5.
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Fig. 6.
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D

coal as fuel. The blast may be obtained by attaching a small pair of tub, or other, bellows, to the engine, and the machinery may be put in motion by using, in the first place, a small quantity of wood. Power enough being thus obtained, to start the bellows, no more wood will be required until after the fire has been suffered to go down and is to be again renewed.

The coal should always be kept, while in full operation, at about the line E, or, at least, so much above the flue B, that it may become perfectly ignited before it sinks to that level. Attention to this is important in preserving a uniform temperature.

The additional power required to propel the bellows, beyond that necessary for the ordinary work to be performed by the engine, will be very small, it is believed not more than a single horse to an engine, of what is called forty horse power, or about two and one-half per cent.; but should it exceed that estimate in a triple proportion, and experience justifies the conclusion that it will not, the economy of room on board of steam boats, where room is so valuable, with other advantages hereafter mentioned, and the saving, in all places, of expense in fuel, will much more than compensate this disadvantage.

But in addition to the economy effected by the introduction into general use for this object, of a fuel existing in inexhaustible quantities in our country, to the exclusion, in many situations at least, of one daily becoming more scarce and costly, a further and important saving will result in the construction of boilers adapted to this furnace; nearly all the space now occupied by the wood, that is, the furnace part of the boiler, may be dispensed with, and in its place be substituted a narrow flue for the passage of the heat under that part of the boiler containing the water. The part that may be dispensed with, forms an expensive part of the whole, while the furnace in which the heat is to be generated, being of a less expensive material, will be much less costly. The great objection to the use of anthracite coal in generating steam, arising from the necessity heretofore supposed to exist, of bringing the fuel in actual contact with, or near approach to, the boiler along its entire surface, is, by this plan, entirely obviated, as the coal is here never in contact with the iron, which, of course, will be much more durable than if constantly acted upon by the direct heat of the fuel.

The principle in the construction of furnaces, and the generation and application of heat by means of anthracite coal and an artificial blast, may be applied with equal advantage to the manufacture of glass, earthenware, pottery, the burning of brick, and all manufactures admitting a like application of heat. B. B. HOWELL.

Notes and references for the improved Furnace for using Anthracite Coal in Generating Steam, and for various manufactures requiring intense heat.

The drawings, Figs. 1, 2, and 3, represent an elevation, a vertical section, and a ground plan, all upon a scale of six feet to an inch; and the same letters refer to the corresponding parts of each.*

* The following errors of the engraver must be corrected. The letter A at

A, A. Tuyeres for introducing blast.
B, B. Line of flue for the passage of flame and heat under the boiler, or other vessel, or body, to be heated.
C, C. Charging doors for coal.
D, D. Cleaning-out doors, occasionally used as draught doors.
E. Line of upper surface of coal.
F, F. Grate bars. Where it is inconvenient to use these, the bottom of the furnace may be closed, as the blast will sufficiently ignite the coal; and the wood first used may be ignited by throwing open the cleaning-out doors, at D, D.
G, G. Openings to promote draught, before applying blast. These may be omitted, in like manner with the bars.

The furnace should be lined with fire brick, and cased with cast-iron plates, secured by strong bolts, screws, and keys; and between these, common brick may be used. If a thin packing, or lining of sand, be also interposed, it will be found useful in preventing injury from expansion.
B. B. HOWELL.

Remarks by the Editor.—But a very few years have elapsed since the general impression in Philadelphia, and other places where attempts had been made to use anthracite as fuel, was, that we might as well attempt to burn bricks and stones; yet it is now known to require less management than any other fuel, and those only experience difficulty, who take too much trouble to succeed. After the coals are once placed in our grates, and ignited, their motto seems to be "*Laissez nous faire,*" and observing this, every thing proceeds with the utmost facility. When it was admitted, not merely to answer well, but absolutely to be the best fire for our parlours, it was still thought by many, that it would never descend into the kitchen, as it was, from its *very nature*, inapplicable to culinary purposes; but here again it was destined to obtain a triumph. The fireman of the steam engine, and the iron master, however, yet remained unconvinced; these averred that they had given it a fair and perfect trial, and that it would never do; there was still something in its *very nature*, which, in their occupations, forbade its use. You might as well have attempted to convince them that it was fit to be made into candles, as that it might be employed for their purposes, if their furnaces were suitably constructed, and the fuel properly managed. It appears likely, however, that it will soon assert its claims to superior excellence, in these applications also, and triumph over the prejudices of the managers of furnaces, as it has over those of the householder, the cook, and the blacksmith.

That many abortive attempts would precede its successful use, was to have been expected, as it differs in so many particulars from the fuel we had been in the habit of using; but it was evident that an intense heat was given out in its combustion, and if we could only transfer this to the water in our boilers, we must convert it

the upper end of the flue, Fig. 1, should be B. There should have been a letter E, at the upper surface of the coal in Fig. 2.

into steam; and in like manner, it must reduce the ore, could the heat, and the carbon, be made to operate upon it. That there was nothing in the nature of things to forbid this, we have ever believed, and are now fully persuaded, that, in all cases, excepting where the action of a large volume of flame is necessary, this fuel may be advantageously employed.

When the application was made for the foregoing patent, some of its leading features appeared to us such as to merit particular attention; the more so in consequence of some circumstances mentioned by Mr. Howell, in a letter which accompanied his other papers; in reply to a communication addressed to him, on the subject of his furnace, he says, "I am not surprised that my statement of the effect produced by the flame of anthracite, has somewhat astonished you. That a fuel, which has, heretofore, been supposed incapable of producing *any* flame, should in truth be so powerful in this respect, is really wonderful. But it has, in reality, been hitherto but little understood, and too much has been taken for granted in relation to it. With regard to this particular property, the error has, I think, been caused by the practice of looking at the upper surface of the coal, the flame from which does not, until the coal is fully ignited, yield much heat, and is liable to great variation of temperature, from the necessity of placing there, new supplies of fuel, which, for a long time, gives no heat whatever. In both my furnaces, you will remark, that the heat is first generated in *close* vessels, and thence taken from that part where the heat is uniform, and most intense; under this arrangement, the effect is, indeed, really astonishing. The length of one of the furnaces in which my experiments were made, was about six feet, and the height of the chimney, ten; or the length of the flue, horizontal and perpendicular, fifteen. The quantity of coal did not, I think, exceed a bushel, certainly not a bushel and a half; and yet the bricks at the top of the chimney were *red hot;* and the flame rose full six feet above the top, strong and vigorous."

"I anticipate that the idea of blowing a steam boat fire, with bellows, will be ridiculed; but this, or something like it, will, I am persuaded, be adopted. Perhaps I go too far in thinking that it may be applied to glass-house furnaces, &c. but time will determine."

We think Mr. Howell's remarks highly interesting, and hope soon to hear from him the results of his further important investigations and experiments. For the fact of a flame of six feet in height, from anthracite, we were not prepared; nor are we now of opinion that the flame actually extended from the fire to the top of the chimney, but believe that the flue was filled with heated air, consisting of nitrogen, carbonic acid, and carbonic oxide, and that the latter inflamed on its coming in contact with the oxygen of the atmosphere.

This remark has little to do with the practical utility of Mr. Howell's furnace, and is intended only to apply to the theory of the production of the flame, which issued from the chimney, and which, we apprehend, was not twenty-one feet in length.

Specification of a patent for an improvement in the manufacture of Malleable Iron, and of an improved Bloomery Furnace. Issued to BENJAMIN B. HOWELL, *Philadelphia, November* 6, 1828.

THE discovery consists of an improvement in the construction of the Bloomery furnace,* by means of which, and the use (in the manner hereinafter described,) of anthracite coal, exclusively, for fuel, iron ore is directly converted into malleable iron.

The drawings exhibit an elevation, and vertical and horizontal sections. By these, and the notes and references appended thereto, it will be seen that this furnace combines within itself, the advantages of both a close furnace and an open fire; in this respect differing, essentially, from any other now in use for similar objects. In the upper or close portion, being all that above the hearth, with anthracite coal excited by a proper blast, a degree of heat is obtained much greater than can possibly be generated in the ordinary fire with charcoal; while the lower portion opening into the hearth, and permitting the free action of blast upon the burthen, performs all the offices of the open fire, or forge. The size of the furnace and the proportions may be varied, if the principle of the close and open fire be retained.

The furnace being first heated up in the manner of a common cupola, the process is thus conducted. The coal having settled sufficiently for that purpose, it is charged with the proper burthen of ore, which will vary according to the quality and kind. The charges are then continued, alternately of coal and ore. The ore soon arrives at the tuyeres in a state of partial fusion, and is then, by the intense heat of that part of the furnace, quickly separated from its earths; and then rapidly descending into, and below the direct action of, the blast, a large part of which is driven out at the open front, first passing over that portion of the ore which has reached the hearth, it is thereby brought, in the language of the workmen, "to nature," or, in other words, into malleable iron.

As it sinks into the region of the blast, the small masses may be driven into one, and a loup shaped by giving a proper direction to the pipes at the different tuyeres, and the loup can be removed with a proper instrument, another instrument, or strong iron bars, being introduced at B, to hold up the burthen while this is doing. The loup may be drawn into a bloom under a forge hammer, or passed through rollers. In either operation it will, of course, be necessary to renew the heats, which may be done in a common chaffery, or in a heating furnace. This process is continued at the pleasure of the workmen, and as soon as a quantity sufficient for a loup accumulates, it is withdrawn, as above described.

In the early stage of the operation it will be necessary to charge the furnace nearly, or quite, to the top; but, as the heat increases, the height of the coal may be gradually diminished, and at a very

* Bloomery is here used in the sense commonly understood in this country.

high temperature, from two to three feet of coal will be found sufficient.

The cinder produced in this way will, in all respects, resemble forge, or bloomery cinder, and will bear working a second time; an appropriate flue facilitates the operation, and, as it is first fused, and sinks, and is thus interposed between the iron at the bottom of the hearth, and the coal, it contributes to prevent a mixture of the two.

Holes may, or may not, be left in the sides of the furnace for the introduction of bars to aid in detaching the iron from the bottom and sides; but this will not often be necessary, if the back of the furnace be thrown sufficiently forward and a proper direction be given to the blast; for which purpose, tuyeres are placed in different positions on three sides of the furnace, and at different elevations. One or two pipes may be used at pleasure.

From the foregoing, it must be obvious that by the rapidity of the process, the saving thereby of time and labour, the substitution of a cheaper, more powerful and abundant fuel, for that now in use, and which is so made applicable to this object, by the peculiar construction of this furnace, that a great and important improvement has been effected in the conversion of iron ore into malleable iron.

B. B. HOWELL.

Notes and References for the improved Bloomery Furnace.

The drawings, Figs. 4, 5 & 6. Plate IV., represent an elevation, and vertical and horizontal sections, all drawn upon a scale of three feet to an inch, and the same letters refer to the corresponding parts of each.

A.—Trundle head where the furnace is charged; to be provided with a cover, which is placed on in the intervals of charging, when the coal is low.

B.—Projecting, open, hollow hearth, for the reception of cinder and iron, with a cinder hole at C, to be opened when it is wished to draw off the cinder.

DD.—Tuyeres, for the introduction of the blast, placed in different positions on three sides of the furnace, and at different elevations, to vary the direction of the blast at different stages of the process.

The back and front in-walls may both, or either, be thrown or inclined somewhat more inward than is represented in the drawing, and as indicated by the dotted lines in the vertical section; and with advantage when the ore is not very pure, and makes much cinder.

The furnace should have over it a brick canopy, or a chimney, to aid in giving a direction to the gas given out by the coal, which is distressing to the workmen if largely diffused immediately around it.

The furnace should be lined with fire brick, and cased with cast iron plates, secured by strong bolts, keys and screws, and, between the casing and lining, common brick with a thin packing of sand; the latter, to prevent injury from expansion.

B. B. HOWELL.

Notes on the foregoing.—In a letter from the patentee, which was received with his application, he observes, "I some time since men-

tioned to you, that I had then completed some further experiments with anthracite coal, the result of which I should soon communicate to you, and which I thought would both interest and surprise you. The papers which I enclose will explain what these experiments were. They relate to an improvement in the Bloomery furnace, and in the conversion of iron ore into malleable iron, with anthracite coal, exclusively. In this, in six different experiments, I completely succeeded, making, in a comparatively short time, perfect bar iron, and, indeed, nails, without suffering it ever to cool. Practical forgemen, who performed the manual labour, were astonished beyond measure, at the result: it was, indeed, complete in every respect, the iron being as good as that made at the neighbouring forges, in the old way.

"Refining of pig-iron, has been attempted in Pennsylvania, but, I believe, abandoned, from the difficulty of preventing a mixture of coal with the iron, in its soft state; this, in my method, is obviated, almost entirely. The process is rapid, and even here, where the coal is high, is economical; how much more must it be so, where coal, and ore, can be had for digging."

The editor has in his possession, a part of the bar, and a nail, forged directly, and without cooling, from the first bloom made in this way; he will seek for further information upon the progress of this improvement.

Manufacture of Diamonds.

At a recent meeting of the Academie des Sciences, a letter was read from M. Gannal, stating the result of his inquiries into the action of phosphorus, brought into contact with pure carburet of sulphur.

Having occasion to prepare a large quantity of carburet of sulphur, M. Gannal conceived the idea of endeavouring to separate the sulphur of this product, in order to obtain a pure carbon. Phosphorus was the material which he used; and he found that the phosphorus entering into combination with the sulphur, the carbon was set at liberty in the shape of small crystals, possessing all the properties of the diamond, and especially that of scratching the hardest bodies. The following is a detail of the experiment:—

If several rolls of phosphorus are introduced into a matrass containing carburet of sulphur, covered with a layer of water, the moment the phosphorus finds itself in contact with the carburet, it dissolves, and, becoming liquid, is precipitated to the lower part of the matrass. The whole mass is then divided into three distinct layers; the first formed of pure water, the second of carburet of sulphur, and the third of liquefied phosphorus. Things being in this state, if the matrass be agitated so as to cause the mixture of the different bodies, the liquor grows thick, becomes milky, and, after a little rest, separates anew, but only into two layers; the up-

per one of pure water, the under one of phosphuret of sulphur; and between those two layers, there is a very thin stratum of white powder, which, when the matrass is exposed to the sun's rays, exhibits all the colours of the prism; and which, consequently, appears to be formed of a multitude of little crystals.

Encouraged by this experiment, M. Gannal endeavoured, by the following process, to obtain larger crystals, and succeeded. He introduced into a matrass, placed where it would be quite undisturbed, first eight ounces of water, and then eight ounces of carburet of sulphur, and eight ounces of phosphorus. As in the preceding experiment, the phosphorus dissolved; and the three liquids arranged themselves in the order of their specific gravity. After four-and-twenty hours, there was formed between the layer of water and the layer of carburet of sulphur, an extremely thin pellicle of white powder, having here and there several air-bubbles, and various centres of crystallization, formed, some by spars of very thin sheets, and others by stars. In the course of a few days, this pellicle gradually grew thicker. At the same time, the separation of the two inferior liquids became less complete; and in three months they appeared to form but one and the same substance. Another month having elapsed without any new result, the question was, how to find means of separating the crystallized substance from the phosphuret of sulphur, to which the inflammability of the mixture presented great obstacles. After several attempts, more or less unsuccessful, M. Gannal determined to filter the whole through a chamois skin, which he afterwards placed under a glass bell, taking care, from time to time, to renew the air. At the end of a month, this skin becoming capable of being handled without inconvenience, it was doubled up, washed, and dried. For the first time, M. Gannal was then enabled to examine the crystallized substance which remained on its surface. Exposed to the sun's rays, this substance presented numerous crystals, reflecting all the colours of the rainbow. Twenty of them were large enough to be taken up with the point of a penknife; and three others were of the size of a grain of millet. These last, having been submitted to the inspection of an experienced jeweller in Paris, were pronounced by him to be real diamonds! A. M. Delatour states that he has, also, produced the diamond by a different process, of which a brief notice shall appear in our next. [*Lit. Gazette.*

Great Ship Canal of the Netherlands.

The object of the Great Canal, is, to afford a passage for large vessels from Amsterdam to the sea. This city has forty feet of water in the road in front of its port, but the Pampas, or bar in the Zuyder Zee, seven miles below, has only a depth of ten feet, and hence all ships of any considerable burden, have to unload part of their cargoes with lighters, before they enter the port. As the sea

in question is full of shallows throughout, all ordinary means of improving the access to the port, were necessarily ineffectual; and the resolution was, therefore, at length adopted, of cutting a canal from the town to the Helder, the northernmost point of the province of Holland. The distance between these extreme points is 41 English miles, but the length of the canal is about 50½. The breadth at the surface of the water, is 124½ English feet (120 Rhinland feet;) the breadth at bottom 36; the depth, 20 feet 9 inches. Like the Dutch canals, generally, its level is that of the high tides of the sea, from which it receives its supply of water. The only locks it requires, of course, are two tide locks at the extremities; but there are, besides, two sluices with flood-gates in the intermediate space. It has only eighteen bridges (draw-bridges) in its whole length. The locks and sluices are double, that is to say, there are two in the breadth of the canal; and we learn from Mr. Bald, that their construction and workmanship are excellent. They are built of brick for economy, but bands of lime-stone are interposed at intervals, and these project about an inch beyond the brick, to protect it from abrasion by the sides of the vessels. There is a broad towing-path on each side, and the canal is wide enough to admit of one frigate passing another. From the river Ye at Amsterdam, it proceeds north to Purmerend, thence west to Alkmaar Lake, thence north by Alkmaar to a point within two miles of the coast, near Petten, and it continues to run nearly parallel to the coast from this point to the Helder, where it joins the sea, at the fine harbour of Niewediep, formed within the last thirty years. At the latter place, there is a powerful steam engine for supplying the canal with water during neap tides, and other purposes. The time spent in tracking vessels from the Helder to Amsterdam, is eighteen hours. The Helder point is the only spot on the shores of Holland that has deep water; and it owes this advantage to the Island of Texel, opposite, which, by contracting the communication between the German Ocean and the Zuyder Zee, to a breadth of a mile, produces a current which scours and deepens the channel. Immediately opposite the Helder, there is 100 feet of water at high tides, and at the shallowest part of the bar to the westward, there are twenty-seven feet. In the same way, the artificial mound which runs into the lake or river Ye, opposite Amsterdam, by contracting the water-way to about 1000 feet, keeps a depth of forty feet in the port (at high water,) while above and below there is only ten or twelve. The canal was begun in 1819, and finished in 1825. The cost was estimated at ten or twelve millions of florins, or about one million sterling. If we compute the magnitude of this canal by the cubic contents of its bed, it is the greatest, we believe, in the world, unless some of the Chinese canals be exceptions. The volume of water which it contains when filled, or the *prism de remplissage*, is twice as great as that of the New York Canal, or the Canal of Languedoc, and two and a half times as great as that of the Caledonian Canal, if we include only those parts of the latter which have been cut with human labour.

[*Lond. New Monthly Mag.*

Franklin Institute.

A meeting of the board of managers was held at the hall, January 20, 1829.

James Ronaldson, president, in the chair.

The actuary read so much of the minutes of the annual meeting of the Institute, held the 15th inst. as related to the election of this board.

Whereupon, the board went into an election for chairman and curators for the ensuing year. Messrs. Samuel J. Robbins and Isaac B. Garrigues, were appointed tellers, who reported the following gentlemen duly elected, viz.

Henry Horn, Chairman,
George Fox, and Thomas M'Euen, M. D. } Curators.

On motion, it was *Resolved*, that the stated meetings of this board be held on the second Thursday evening in every month.

The candidates proposed at the last meeting of the former board, were duly elected members of the Institute.

A stated meeting of the board of managers was held at the hall on Thursday, February 12, 1829.

Mr. Henry Horn, chairman.

The minutes of the last meeting were read and approved.

The chairman appointed the following standing committees, which were approved by the board, viz.

On Instruction.

George Fox, J. B. Garrigues, Henry Horn, Thomas M'Euen, M. D. Wm. Yardley, jr. Isaac Collins, Charles Wheeler, C. D. Meigs, M. D. Charles Roberts, R. R. Lewis.

On the Library.

Isaac Hays, M. D. Charles H. White, George Fox, Thomas Loud, Frederick Fraley.

On the Cabinet of Models.

Rufus Tyler, John Struthers, John O'Neill, Joseph H. Schreiner, Thomas Scattergood.

On the Cabinet of Minerals.

Abraham Miller, Isaiah Lukens, Isaac Hays, M. D. Thomas M'Euen, M. D. James Rowland, jr.

On Premiums and Exhibitions.

James Ronaldson, Adam Ramage, Isaiah Lukens, Mordecai D. Lewis, Christian Gobrecht, Mathias W. Baldwin, Samuel J. Robbins, Algernon S. Roberts.

On Publications.

Samuel V. Merrick,
Isaac Hays, M. D.
Rufus Tyler,
Isaiah Lukens,
Mathias W. Baldwin.

On Inventions.

James Ronaldson,
Mathias W. Baldwin,
Christian Gobrecht,
Isaiah Lukens,
Andrew Young,
Samuel V. Merrick,
Benjamin Reeves.

Managers of the Sinking Fund.

Samuel V. Merrick,
Ashbel G. Ralston,
Samuel J. Robbins.

Auditors.

Abraham Miller,
Isaac B. Garrigues.

The special committee appointed by the late board, at the request of Mr. Isaac M'Cauley, to visit his floor cloth manufactory, presented a report, which was read, and on motion, the actuary was directed to furnish Mr. M'Cauley with a copy.

The corresponding secretary presented the following communications, viz. a work, entitled, "Du Développement, à donner à quelques parties principales et essentielles de notre Industrie Intérieure," from the author, M. de Moleon, Chief Engineer of the king's cabinet, and of the Royal Domains of France. And, also, a letter from the same, requesting to be elected a correspondent. A letter from M. Chersant, Vice Consul of France, enclosing the above, and offering to transmit any communications for the Institute.—A letter from the Franklin Institute of Rochester, New York, acknowledging the receipt of the Journal of the Franklin Institute, for the past year, and expressing a desire to continue the correspondence.

Whereupon, it was *Resolved*, that the corresponding secretary be instructed to forward the Journal of the Institute to that Institution, as published, and to continue the correspondence.

On motion, it was *Resolved*, that a committee be appointed to report to this board the design and expense of a diploma of membership, to be issued to the members of the Institution. Isaac Hays, M. D., and Messrs. Samuel V. Merrick and Thomas Loud were appointed said committee.

Resolved, that the above committee be instructed, also, to report the design of a certificate, to accompany the medals awarded at the exhibitions of the Institution.

Resolved, that a committee be appointed to report a plan for the monthly meetings of the Institution. Isaac Hays, M. D., and Messrs. Samuel V. Merrick and Rufus Tyler were appointed said committee.

Resolved, that a committee be appointed to have cases for the cabinets of minerals and models put in the meeting room. Isaac

Hays, M. D., Thomas M'Euen, M. D., and Mr. Isaiah Lukens, were appointed said committee.

Resolved, that the committee on premiums and exhibitions be instructed to prepare a list of premiums to be awarded at the next exhibition to be held by the Institute.

The election of members of the Institute, proposed at the last meeting, was called for, when M. de Moleon, of France, was duly elected a correspondent, and Dr. Thomas P. Jones, of Washington city, an honorary member, and the remaining candidates were elected members of the Institution. Extract from the minutes.

WILLIAM HAMILTON, *Actuary.*

Prevention of Forgery.

[From Silliman's Journal.]

Messrs. James Atwater and N. & S. S. Jocelyn, of this city, (New Haven,) have completed a plan to prevent forgeries and alterations of bank checks, drafts, bills of exchange, post notes, notes of hand, and other similar instruments.

The labour of carrying into effect such a design, may be, in some measure, understood, when it is considered, that to the accomplishment of a plan which shall obviate all the difficulties of the present mode of doing business, particularly by means of checks, the several following points should be compassed, viz.

Banks should be protected against losses arising from the depredations of swindlers, effected both by original forgeries and by alterations of genuine checks; and the characters of honest dealers, and tellers of banks, should be preserved from the unjust suspicions which may now, sometimes, arise from the impossibility of tracing a forgery to its origin. All these exposures exist in the present mode of transacting the business of banks, and the calamitous consequences too frequently arrest the public attention.

That these various objects can be embraced in one plan, within the ordinary limits of instruments of the kinds referred to, and yet admit of that simplicity and facility which the rapid transaction of business requires, is an idea, which, if it ever occurred to any person, was, probably, regarded only as something to be desired, but scarcely to be hoped for; and, consequently, the old and exposed method has continued in use, with all its temptations to the vicious and the unfortunate. It is believed that no attempts have been made hitherto, to accomplish more than one of these objects, and that with but doubtful success.

The inventors of the plan now spoken of (which they have secured by patent) claim to themselves the merit of conceiving and executing the whole combination of desiderata, and of removing all the obstacles which necessarily present themselves, in an attempt to establish a consistency in the union of so many important points. In the labour and experiments consequent on this undertaking, they have

spent more than an entire year; and the result, in the estimation of gentlemen connected with banking institutions, is such as to justify the opinion, that their efforts have been successful, and that the general adoption of this plan will secure the most desirable consequences. It is considered as original; and, in the opinion of the most competent judges, it certainly is so in its whole combination and effect, and in nearly all its details.

As regards the liability hitherto existing in all the instruments of the kinds above-mentioned, to successful alterations usually effected by the application of chemical agents, they have provided an effectual preventive, so that even signatures and sums may be altered, without its being possible for the swindler to avail himself of his fraud, without encountering a moral certainty of detection.

The frequency of frauds, and the prospect that they will continue to increase with the progress of population, business, and the arts, unless effectual efforts are made to oppose every obstacle to their growth, and, if possible, to remove every hope of success in the attempt, is a sufficient reason for pressing on the attention of the public, and, especially, of the officers of banks, a plan which promises to accomplish the desired object. We have critically examined the plan above proposed, and have seen it examined by skilful men of business, and by experienced officers of banks; and, if there is any mode of evading the effect of this ingenious and important invention, we confess we have not sufficient sagacity to discover it. [*Editor.*

Employment of Iodine as a Dye.

It appears from a note by Pelletier, that he ascertained, during a recent journey in England, that a large quantity of perioduret of mercury is sold in that country, under the name of English vermilion, which is employed principally in the preparation of paper hangings. Learning, also, that iodine was used in printing calico, he analyzed a specimen of the colouring material from Glasgow, and succeeded in forming a compound, which was a perfect imitation of the English salts. The proportions which he found to succeed best, were the following.

Hydriodate of potash, - - - - -	65
Iodate of potash, - - - - -	2
Ioduret of mercury, - - - - -	33
	100

This salt appeared to have cost, in England, one hundred francs the kilogramme (2 lb. 3 oz.) but could be prepared in France for thirty-six francs, reckoning the iodine to cost forty francs.

"It appears to me (observes this skilful chemist) that this salt ought to be applied to the stuff before it is passed through metallic solutions. Among the latter, those which give the most beautiful colours, are the solutions of lead and mercury. This salt may be

applied with advantage to stuffs, by the aid of a solution of starch, which becomes a beautiful violet, (a known effect of iodine and starch.) The starch appears, also, to contribute to fix the salt on the stuffs.

There is another salt, also, much employed, it is said, in Glasgow, in calico printing, which I ought, also, to mention, because it appears not to be much used in France. This is a triple acetate of lime and copper, prepared in the large way, by Ramsay, at Glasgow, for the printers. This salt is of a very beautiful blue. It crystallizes in straight prisms with square bases. The summits of the prisms are often replaced by facets, whence result prisms with six or eight planes, according to the extension which the secondary faces acquire.

When this salt is decomposed by a fixed alkali, the oxide of copper and lime are precipitated, combined, because they meet in the nascent state, and in definite proportions. It is certain that the precipitate turns green but little in the air, even in drying, and in its application, it is a kind of *ash blue*, which becomes fixed on the stuff. I call the attention of cotton printers to this salt, which may furnish very beautiful dyes, and which cannot become very expensive. [*Bulletin d'encouragement*, *Sept.* 1828.

Evaporation by means of Bladders.

M. Sæmmering, in a memoir in the Academy of Sciences of Munich, states that alcohol, in a vessel covered with a bladder, the latter not being in contact with the fluid, loses, when exposed to a dry atmosphere, much of its water, and becomes stronger. But if the vessel thus closed, be exposed to a damp air, the alcohol attracts humidity and becomes weaker.

In a second memoir, the author states more particularly the effect of bringing the alcohol into immediate contact with the membrane. If a bladder be filled with 16 ounces of alcohol at 75°, and be well closed and suspended over a sand bath, or placed near a warm stove, so as to remain at the distance of more than an inch from the hot surface, it becomes, in a few days, reduced to a fourth of its volume, and is nearly, or quite, anhydrous.

M. Sæmmering prepares for this purpose, calves' or beeves' bladders, by steeping them first in water, washing, inflating, and cleansing them from grease and other extraneous matters, tying the ureters carefully, and then returning them to the water in order to clear off more fully the interior mucocity. After having inflated and dried the bladders, M. S. covers them with a solution of Ichthyocolla, one coating internally and two externally. The bladders thus become firmer, and the alcoholic concentration succeeds better.

It is better not to fill the bladder entirely, but to leave a small space empty. The bladder is not moist to the touch, and gives out no odour of alcohol. If the latter be below 16° Baume, the bladder then softens a little, and appears moist to the touch.

Bladders prepared as above, may be employed more than a hundred times, though they at length acquire a yellowish-brown colour, and become a little wrinkled and leathery. The swimming bladder of the salmon is not fit for these experiments. Alcohol of 72° was put into one of them, and after an exposure of thirty-two hours, it had lost more than one-third of its volume, and was weakened 12°. The alcoholic vapour was perceived by the smell.

Into two bladders of equal size was put, into one, eight ounces of water, and into the other, eight ounces of alcohol. They were placed side by side, exposed to a slight heat. In four days the water had entirely disappeared, while the alcohol had scarcely lost an ounce of its weight. Mineral waters, and that of wells, evaporate and deposit on the interior of bladders, the saline matters which they contain.

If the heat be conveniently managed, absolute alcohol may be obtained in six to twelve hours. Solar heat is even sufficient to produce anhydrous alcohol.

Wine placed in prepared bladders, contracts no bad odour; it assumes a deeper colour, acquires more aroma, and a milder taste, and becomes, generally, stronger. Spirits of turpentine of 75°, contained in a cylindrical glass closed with a bladder, lost nothing in four years. Concentrated vinegar, lost the half of its volume in four months, the other half acquired more consistency, and had no longer an acid taste. The water of orange flowers, was about one-third evaporated in a few months, appeared to have a stronger odour, and, consequently, had lost nothing of its volatile principle.

[*Ferussac's Bulletin*, *Mai*, 1828.

Method of Preserving Fruit without Sugar.

You must use wide-necked bottles, such as are used for wine and porter. Have the bottles perfectly clean. The fruit should not be too ripe. Fill the bottles as full as they will hold, so as to admit the cork going in. Make the fruit lie compact; fit the corks to each bottle, slightly putting them in that they may be taken out the easier when scalded enough; this may be done in any thing which is convenient; put a coarse cloth of any kind at the bottom of the vessel, to prevent the bottles from cracking; fill the vessel with water sufficiently high for the bottles to be nearly covered in it; turn them a little one side, to expel the air that is contained in the bottom of the bottle; then light the fire; take care that the bottles do not touch the sides nor the bottom of the vessel, for fear they will burst, and increase the heat gradually, until the thermometer rises to 160 or 170°. If such an instrument cannot be procured, you must judge by the finger; the water must not be so hot as to scald. It must be kept at that sufficient degree of heat for a half hour; it should not be kept on any longer, nor a greater heat produced than above-mentioned. During the time the bottles are increasing in heat, a tea-

kettle of water must be ready boiled, as soon as the fruit is done. As soon as the fruit is properly scalded, take the bottles out of the water one at a time, and fill them within an inch of the cork, with the boiling water. Cork them down immediately, doing it gently, but very tight, by pushing the cork in, for agitation will be apt to burst the bottles; lay the bottles on the side, to keep the air from escaping. You must take care to let them lie on their sides until wanted, often turning them over, once in a week, or once in a month.

[*Silliman's Journ.*

Fine Red Colour from Walnuts.

A chemist of Brussels, who was recently washing his hands, which were stained with walnuts, in some water which was impregnated with chlorurite of lime, found, to his surprise, that the water became beautifully red. He repeated the experiment, and concludes from it that the colour produced by the mixture of the rind of the walnut with the chlorurite, may be rendered useful to the arts.

[*Register of Arts.*

To Preserve Iron from Rust.

We do not know any thing more convenient, and at the same time as cleanly and permanent, as a little bees' wax brushed over the articles. A solution of caoutchouc in five times its weight of oil of turpentine, and this solution dissolved in eight times its weight of drying linseed oil, which forms the varnish of air-balloons, is much recommended. Grease, oils, tallow, &c. are filthy applications, soiling every thing that comes in contact with them; and from the acids and water contained in them, they, after a time, corrode the metal they were intended to protect. There is a method adopted in manufactories, of steeping bright iron articles in lime water, which preserves them for a considerable time against corrosion: our chemists might, perhaps, avail themselves of this hint to prepare some good composition for preserving this most valuable of the metals. [*Ib.*

LIST OF ENGLISH PATENTS.

List of Patents which passed the Great Seal, from August 28th to September 25th, 1828.

To George Stratton, gentleman, for his inventing an improvement in warming and ventilating churches, hot-houses, and all other buildings, which improvements may be applied to other purposes—August 28.

To Granville Sharp Pattison, Esq. in consequence of a communication from a foreigner residing abroad, of a new and improved me-

thod of applying iron in the sheathing of ships and other vessels, and of applying iron bolts, spikes, nails, pintals, braces, and other fastenings, used in the construction of ships and other vessels—September 4.

To John Seaward and Samuel Seaward, Engineers, for their having invented a new and improved method or methods for propelling or moving carriages and all other vehicles on roads, and also ships, boats, and other vessels on water—September 4.

To Charles Sanderson, Iron Master, for his having invented a new method of making shear steel—September 4.

To Samuel Brooking, Esq. a rear admiral in the Royal Navy, for his invention of a new method or mode of making sails of ships and other vessels—September 4.

To John Robertson, Rope Manufacturer, for his invention of certain improvements in the manufacture of hempen rope or cordage—September 4.

To William Bell, gentleman, for his having invented improved methods for filtrating water and various other liquors—September 4.

To William Farish, Jacksonian Professor in the University, for his having invented an improved method or methods of clearing out water-courses—September 4.

To Thomas Robinson Williams, for his having invented or found out certain improvements in the making of hats, bonnets, and caps, and in the covering of them with silk and other materials, with the assistance of machinery—September 11.

To Thomas Milikew, Cabinet Maker, for his having invented or found out an improvement in the construction, making, or manufacturing of chairs, sofas, lounges, beds, and all other articles of furniture, for similar purposes, and also of travelling and other carriages and vehicles of every description, for personal use—September 11.

To James Beaumont Neilson, Engineer, for his having invented and found out an invention for the improved application of air to produce heat in fire forges and furnaces, where bellows, or other blowing apparatus, are required—September 11.

To Lemuel Wellman Wright, Engineer, for his having invented certain improvements in machinery for making screws—September 18.

To William Losh, Esq. for his invention of certain improvements in the formations of iron rails for rail-roads, and of the chairs or pedestals, in or upon which the rails may be placed or fixed—September 18.

To Joseph Rhodes, the younger, Worsted Spinner, for his having invented certain improvements in machinery for spinning and twisting worsted yarn, and other fibrous substances—September 18.

To Joseph Clisild Daniell, Clothier, for his having invented improvements in the machinery used for dressing woollen cloth—September 18.

To John Melville, Esq. for his having invented certain improvements in propelling vessels—September 18.

To Edward Forbes Ocson, gentleman, for his having invented an improved cartridge for sporting purposes—September 18.

To John Jones, Brush Maker, for certain improvements in machinery, or apparatus, for pressing and finishing woollen cloth—September 25.

LIST OF FRENCH PATENTS.

Granted in the last quarter of the year 1827.

(Concluded from p. 80.)

To Clement Desormes, of Paris, for a new construction of rooms destined to the manufacturing of sulphuric acid—15 years.

To Migeon of Morvillars, for a machine to form the heads of wood screws by heat—10 years.

To Delacoux, of Paris, for an improved harp—10 years.

To Choel nec Marie, Marquerite Leger, of Paris, for a method to cut out the edges of bobbin net—5 years.

To Adam Jacques Francois, of Paris, for a moveable binding of books—10 years.

To Bertaux Alexandre Murie, of Paris, for means to prevent the oversetting of carriages—10 years.

To Thinat of Nantes, for a new high pressure steam engine—10 years.

To Lamothe Jean, of Montreal, to make Bagliamy's distilling apparatus portable—10 years.

To Strylosh William, of Lyon, for a process of manufacturing tallow candles imitating wax candles—5 years.

To Beauduin Vramenne Servais Joseph, of Sedan, for a machine to prepare any material destined to the selvage of cloth—10 years.

To Perkins, Jacob, a citizen of the United States, for improvements in steam engines—15 years.

To Becasse Pierre Victor, of Paris, for a carriage trigger with a moveable lever—5 years.

To Bernhard Antoine, of Berlin, for an apparatus to raise water or any other fluid, by the pressure of the atmosphere only—15 years.

To Galy-Cazalat, of Nancy, for an acrostatic lamp, and candlestick—10 years.

To Chamboredon Louis Cesar, of Alais, for a mechanical power, he calls "conservateur des forces"—5 years.

To Wright Lemuel Wellman, of London, for a new improved crane—15 years.

To Gourlier, Adrien Jean Baptiste, of Paris, for a boot iron he calls "fer mobile cylindrique"—5 years.

To Petit Pierre Jean Henri, for a machine he calls typomelographique, for engraving music—5 years.

To Boche and Aubin, for a box for measuring the charge of gunpowder—5 years.

To Rolle Frederic and Schivilque Jean Baptiste, for a scale to weigh carriages—10 years.

To Niogret Guillaume, of Paris, for a method of carrying passengers and goods without the power of horses, steam, &c.—10 years.

To Capy, of Paris, for a coffee-pot—5 years.

To Chamblant, Marie Nicolas Joseph, of Paris, for a new mechanical principle to convert the direct into a rotary motion—15 years.

To Vicomte de Barres du Molard Jean Scipion Henri, of Paris, for a new system of bridges with expanded bearings—15 years.

To Duclose Philippe Ignace, of Paris, for a girdle he calls "menouheene," for the use of females—5 years.

To Bostock, James Bethune, of London, for a system of machinery to manufacture metallic screws, commonly called "wood screws"—15 years.

To Duguet, junr. Antoine Nicolas, of Paris, for a machine he calls "petrin mechanique," for making bread—15 years.

To Batilliat Pierre, of Macon, for a chemical substance to substitute for linen rags, in the manufacture of paper—10 years.

To Gervais, of Paris, for a process to improve the manufacturing of wines, brandy, and other spirits—10 years.

To Gibon Jacques Louis, of Paris, for new unalterable picture frames—5 years.

To Poupon Claude, of Nuits, for a wine press—5 years.

To Nuellens, of Paris, for elastic matrasses, &c.—15 years.

To Arnett Thomas, of London, for an improved floating bed—10 years.

To Perkins, Jacob, a citizen of the United States, for additional improvement in steam engines—15 years.

To Moitenier Antoine Prosper Marchand Auguste and Mazeline Jaques Francois, for a cloth shearing machine, called "velocifor"—5 years.

To Fusz Pierre, of Isming, for a mechanical coach trigger, to stop the wheels of carriages—10 years.

To Delaporte Pierre and Berthier, Jerome, for a process to manufacture metal thimbles—5 years.

To Aschermann and Perrin, of Paris, for a blowing machine to cleanse the materials employed in the manufacturing of hats—10 years.

To Capelain, Jean Baptiste Claude, of Rouen, for a cloth shearing machine he calls "mouvement alternatif"—5 years.

Queries.—A subscriber wishes to be informed, through the medium of this Journal, of the best mechanical method for raising water from a well 50 feet deep, for common domestic and culinary purposes.

How many inches of water, under a 15 feet fall, will produce the same effect as 100 inches under a 20 feet fall, both acting on overshot wheels, under a 3 feet head?

Suppose 100 inches of water of 20 feet 6 inches fall, be received at 600 dollars per annum, what will be the value of 100 inches, the fall being 9 feet 8 inches, the situations being otherwise equal?